THE
CONNUBIAL CODE
and Its Complications

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THE COMMON HEAD COLD
AND ITS COMPLICATIONS

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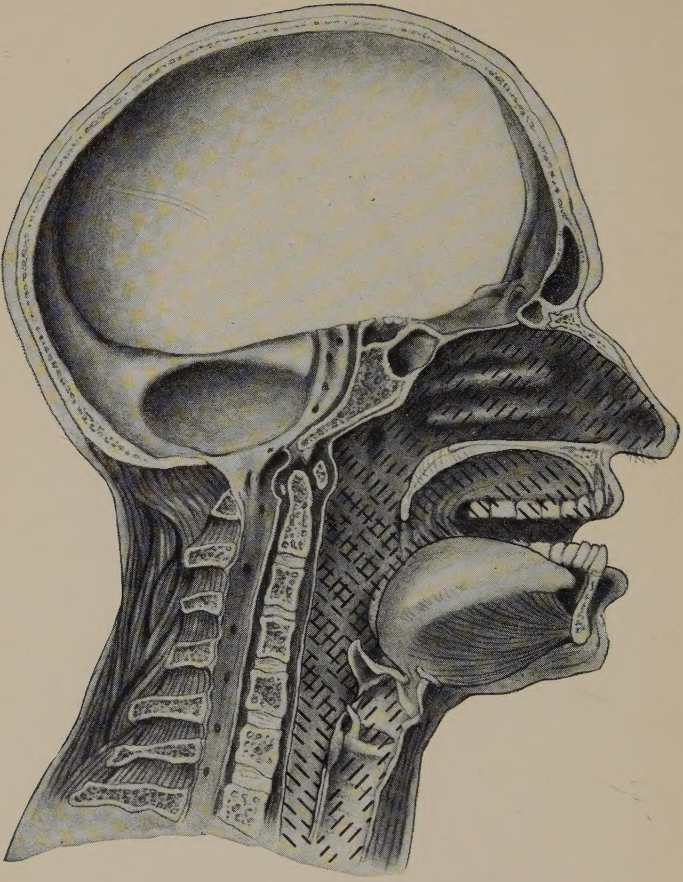

The Crossways of the Throat

Sagittal section through entire head, showing upper air tract (represented by short lines running from above down and backward), upper digestive tract (represented by short lines running from above down and forward) and the common crossways of the two (represented by cross markings).

THE
COMMON HEAD COLD
AND ITS COMPLICATIONS

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WITH AN INTRODUCTION
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TO THE MEMORY OF MY FATHER,

DR. CHARLES AUGUSTINE WELLS,

WHO DEVOTED HIS WHOLE LIFE
TO THE SYMPATHETIC RELIEF OF
THE SICK, THE NEEDY, AND THE
DISTRESSED.

INTRODUCTION

One would not at first suppose that a book of two hundred odd pages could profitably be written about the trite and depreciated ordinary "cold." Yet Dr. Wells has done so, and he has indicated what hygienists believe,—that prevention or mitigation of this pawn of diseases is a key step in increasing our national health and efficiency. Dr. Wells has fearlessly set down his opinions and given the reasons for them, with the result that few questions could be asked about an individual's relation to a cold which are not answered in these pages. Of particular interest are his discussions of the respiratory function of the nose and its relation to the skin, the details of prevention, and the home treatment of colds. The long experience of an able practitioner who deals first hand with many cases of colds and their results is a valuable and helpful contribution to our knowledge; it is a privilege to be let into the secrets of the nose and throat specialist.

Hugh S. Cumming
Surgeon General
United States Public Health Service

PREFACE.

A few years ago an author would have felt that it was necessary to apologise for writing on the subject of the common cold.

Such a trivial subject would have commanded but slight attention from the public or even from medical men, whose chief interest could only be aroused by the discussion of rare cases, new methods of cure or dangerous operations. Recently, however, the conviction has been forced upon us that the ordinary head cold is not a trivial matter, if we regard the ultimate consequences in the individual attacked and the sum total of the effects upon the community, while even slight cases are important because of the universality of the occurrence. There can be no doubt that the unrestricted occurrence of the common head cold seriously affects the health, happiness, and efficiency of the human race.

There has been of late much emphasis placed upon the terrific economic loss resulting from this neglected malady, in the reports of the insurance societies, city and state health boards, and the medical departments of great industrial institutions. To estimate the economical loss resulting from illness is a very difficult problem, for health and sickness are not really measurable in terms of money, but something can be done in this direction.

Vital statistics are available which place the average worth of man's life in industry to the country at $5,000, and the average value of his day's service at $5.00. Now according to a survey made by the Public Health Service, there is, on account of colds in the United States, an average annual loss of work of about two and one-fifth days for each worker, so that taking into consideration only that part of our population engaged in gainful industry, which is about forty-two million, we may figure a loss of more than ninety million work days per year. Rendered in terms of money it means a loss of not less than four hundred and fifty million dollars every year on account of colds alone. This, however, by no means represents the total economical cost of colds, for it does not take into consideration the loss in energy and efficiency for many days following an attack, the loss from illness indirectly due to colds, or the cost of medicine and medical and nursing services.

As evidence of the interest finally awakened on the part of medical bodies, we may cite that colds were recently the subject of a symposium at each of two national medical conventions, viz:— of the Southern Medical Association, and the American Laryngological, Rhinological and Otological Society.* It happens that the author was a contributor on each of these occasions and his interest was increased rather than lessened by the very general discussion of the subject from many different angles. It was generally admitted that the exact nature of the malady is still imperfectly understood, and while there were evidently many differences of opinion as to the manner of its origin and methods of prevention and cure, nevertheless there were agreements along certain lines, which ought to be emphasised and made more generally known.

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* Among those who took an active part in the discussions at the symposia, and who made valuable contributions to the subject in its various phases, we may especially mention: Dr. Beaman Douglas, Dr. Wm. Haskin, Dr. James Dwyer, Dr. Wolf Freudenthal and Dr. Carl Sautter (all of N. Y.), Dr. Geo. B. Wood (Philadelphia), Dr. Frederick Sperry (New Haven), Dr. George Richards (Fall River), Dr. Joseph Beck (Chicago), Dr. Calvin Faunce (Boston), Dr. Ralph Fenton (Portland, Ore.), Dr. Clif-

There is no question more frequently asked the general practitioner, than "why do I catch cold," unless it be, "what shall I do to avoid it?" These are questions that can never be answered by the statement of one simple formula, appropriate for all cases. Each case is a distinct problem, requiring individual study and special application. It is our purpose in the following pages to direct our efforts to answering these questions in as comprehensive a manner as possible, giving not only the underlying and guiding principles, but such particular information that the reader may select that which bears with especial relevancy on his own case.

Are colds contagious? Are drafts harmless? Do vaccines prevent? Is the use of spray and gargles advisable? Ought adenoids and tonsils to be removed? Is sinus inflammation curable? These

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ton Miller (Richmond), Dr. Edward Looper (Baltimore), Dr. Homer Dupuy, Dr. Arthur Weil and Dr. E. C. Myers (New Orleans), Dr. F. B. Cayce (Nashville), Dr. T. W. Moore (Huntington, W. Va.), Dr. J. W. Jervey (Greenville, S. C.), Dr. J. A. Stucky (Lexington, Ky.), Dr. J. D. Heitger (Louisville), Dr. Francis Blackmar (Columbus, Ga.), and Dr. J. F. Rowland (Hot Springs, Ark.)

are some of the vital, pressing questions upon which enlightenment is demanded and urgently needed.

Our aim has been, not only to answer the questions, but to explain to what extent colds are dependent upon general health as well as local conditions, and we include special discussion of the subjects of diet, clothing, exercise, bathing and ventilation, which have a direct bearing upon the tendency to catch colds or the capacity to withstand them. When these matters are thoroughly understood and the knowledge of them put into practice there will be less necessity, we hope, of answering still another question very frequently asked to-day, "what shall I do to get rid of this cold?"

It is especially because the answer to this last question is not always easy, that we have devoted so many pages to the discussion of prevention, but at least it is not so difficult as implied in the answer given by a famous physician to the question, "Doctor, what must I take for a cold?" when he replied, "I think you must take at least ten days."

Much can be done by judicious treatment, which will not only tend to lessen the duration of the cold but to modify its course, to prevent complications and to forestall unfortunate consequences. There is, therefore, included in the work a chapter dealing with home care and the general principles of home treatment, indicating those general measures to be followed, and those which are contrary to sound doctrine, and therefore to be avoided, with instructions as to what the patient may safely do for himself and under what circumstances he should consult a physician to insure recovery.

In this connection it may be said that there is one way that a cold should not be treated, and that is with contempt. It is by no means a negligible complaint, and the habit of so regarding it may sometimes lead to woful consequences. The enormous frequency of this affection, apart from all other considerations, requires that it receive serious attention, and so it has seemed that from the standpoint of prevention, a thorough discussion is justified of all the factors concerned in its origin.

Naturally the complications of a disease must be considered and to such important subjects as Adenoids and Tonsils, Sinus Disease, and Voice Trouble entire chapters have been devoted.

It is hoped that a rational up-to-date presentation of these topics may not be without value in dissipating some of the superstitious opinions and absurd practices that have ever clung to the subject of colds, largely due, we must confess, to the indifference of the medical profession itself and its failure to instruct the general public in a matter of such great importance to health and happiness.

In the preparations of these pages, the author wishes to express his indebtedness to Mr. Arthur Hale for helpful criticism of a literary nature, and for valuable suggestions in the arrangement of the text, and to Mr. Garnet W. Jex for his very skilful handling of data furnished in the execution of a number of original drawings.

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THE COMMON HEAD COLD
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I

COLDS IN GENERAL

Never before, as at the present time has there been upon the part of the general public, such a keen appreciation of the value of hygienic knowledge, and such an earnest effort to benefit through the application of hygienic laws.

This tendency has been stimulated and fostered by the altruistic aims of medical practitioners. It was necessary that the medical profession should, itself, first awake to a proper realisation of the transcendent value of hygiene before it could communicate it to the world at large. It was necessary that it should free itself from its former exclusive and forbidding policy, based upon the theory that the mysteries of physic were for its votaries only, and that it was profane to communicate them to the outside world. But as hygiene has advanced in the esteem of medical writers and practitioners, it has gradually become evident that this branch of medicine is one that requires that the laymen be taken into the confidence of the physician.

Hygiene is the art and science which considers the preservation of health. As a science, it is concerned with every subject which may contribute any knowledge looking to the prevention of sickness and the postponement of death. As an art, it is interested in every means by which this knowledge may be successfully applied. Both philosophy and experience teach that the latter object is unattainable without the helpful and intelligent cooperation of the people toward whom these laudable objects are directed. In other words hygiene as an art requires the alliance of the doctor and layman, and the latter's aid as an ally is in direct proportion of his understanding of hygienic principles and his possession of hygienic facts.

When disease has already taken its hold on an individual, the unfortunate victim does right to call for aid, and quickly. Often-times, completely overcome mentally and physically, he is at the mercy of his foe, and must perish unless his professional protector, armed with sufficient knowledge, judgment and skill can come to his timely rescue and save him. But when the enemy is still afar off, and while the individual is still in normal possession of his strength and faculties, he is then his own best physician, and can save himself by wisely following hygienic counsels. As in time of peace we must prepare for war, so it is in time of health we must prepare against disease.

If the practising physician, fighting enemies of the body already at work, can be likened to a soldier, fighting a personal foe, then the physician in the capacity of hygienist may be compared to the sober statesman, administering counsel tending to the happiness and prosperity of the state and looking to the warding off of evils which may effect the body politic.

The hygienist's duty is to the individual in the state of health, to keep him so; to warn him against the enemies of the body and to teach him how he may avoid them. This he does by instructing him in the laws of healthful living, and by pointing out the evil consequences of their violation, by making him acquainted with the structure of his own body and its functions, and showing him what disorders can come from its abuse and misuse.

It is no doubt a fact that a ceaseless warfare is being waged between the elements which make for health and those which make for disease; between the forces of degeneration and regeneration. This we knew in sort even before Lister and Pasteur revealed to us the myriads of unseen foes, which teem in our midst and threaten our destruction. What should we do to protect ourselves against them and survive in spite of them?

Pasteur

Intelligent beings determined to survive and triumph over the machinations of an ever-present enemy, will find that two methods can be adopted looking to that end, both equally important and necessary. They are (1) to destroy, or weaken the enemy, (2) to strengthen themselves.

So, with regard to man's health, efforts are to be directed not alone toward overcoming and destroying disease, but likewise, toward increasing the powers of resistance. To succeed in either of these purposes the first requisite is knowledge; knowledge of disease, knowledge of ourselves.

It is therefore within the province of hygiene, and we may say one of the most effective measures it possesses for prevention of disease and the preservation of health, to spread and popularise so far as it is practicable a knowledge of the human body, explaining the principles that govern its action and laying down rules and regulations for maintaining it in a state of health.

Hygiene without preachment would be like the play of Hamlet with Hamlet left out. As well might theologians confine religion to themselves, denying the necessity of spreading its doctrine among men, as hygienists fail to propagate hygienic knowledge. The very life of hygiene consists in a propaganda, just as the missionary spirit is the soul of Christianity.

The question may, however, be very properly raised as to the limit to which the professional man should go in his effort to instruct the public.

It is obviously unwise to attempt to convey information of the character and extent of that suitable to the physician. People who have other things to do, and other subjects to learn, will have neither time, inclination, nor capacity for the minutiae of medical lore.

The general public must then be supplied only what it can absorb and utilise, and it is therefore the business of the hygienist to carefully select and judiciously prepare, out of the great abundance at hand, such material as will be suitable.

There is no subject, no matter how apparently abstruse and intricate, or how overburdened with material, which may not be classified and simplified and ultimately rendered fit for popular absorption. This the hygienist must do, keeping always in mind practical needs and practical purposes.

The particular ailment which is considered in this treatise needs above all others to be made the subject of hygienic education. This is true: first, because the common cold is the most frequent of all diseases; secondly, because the consequences are serious, and thirdly, because it is an affection which to a very great extent is preventable.

Common cold

first
1 frequen
v Seriou
3 preventa

Of the actually serious nature of a common cold, there is no adequate appreciation on the part of the public, nor, for that matter, on the part of the medical profession as a whole. To regard whatever is common as of only inferior importance is an error to which all mankind is admittedly more or less liable. In fact, so widespread and so deep-rooted is this general tendency that it has taken a strong hold even upon our language, and we find that the adjective "common" is used synonomously with what is unimportant.

synonym
Common
= unimporta

It is very likely that this secondary construction is frequently put upon the expression "a common cold". To such a misinterpretation of its true significance we desire to enter a protest.

The so-called "cold in the head" is certainly one of the most universal of ills to which flesh is heir. The doctor as well as the layman has had his personal experience of it. It affects alike the rich and the poor, the old and the young, the white and the black. It occurs in all climates, in all countries, and at all seasons. But this universality of its distribution, this commonness of the common cold, instead of giving rise to a sense of security and suggesting a policy of inaction, ought rather to have a reverse effect, and put us on our constant guard against an enemy that surrounds us on every side, and against attacks from which we are exposed at any time and in all places. A "cold in the head" is in fact the entering wedge of disease; it is a small break in the embankment which protects good health; it is a rust formed upon the constitution which, besides the harm it does of itself, favours the formation of additional deposits. It is a very true, as well as very witty, remark that was made by Woods Hutchinson when he said that man's life ought to be measured not by the years that pass over his head, but by the colds that pass through it.

The term "a cold" is generally used to embrace the process by which the malady arrives rather than the effect, as when we say such and such a disease is due to "catching cold." We are confining ourselves chiefly to the consideration of a cold localised in the nasal passages, because it is here that it occurs in its most typical form. If we know all about head colds, we shall know all about colds in general. It is by long odds the most frequent kind of cold and is as a rule the starting point of colds elsewhere in the body.

The nose standing at the very threshold of the respiratory tract is, in a sense, an internal organ with an external exposure, and it must bear the brunt of the attacking hordes of germs, together with the dust and other impurities entering with the inspired air. A very special reason why colds have their favourite seat in the nasal passages is because, in the performance of its respiratory functions, the nose has to both warm and moisten the inspired air and therefore must react to the variations in the physical properties of the surrounding atmosphere, which are looked upon as the chief cause of colds.

There is evidently still some idea abroad that a cold is something very different from an inflammation. We must recognise it however as, in fact, a form of inflammation, caused by the same agents, manifesting the same phenomena, and subject to the same general principles of treatment.

"Inflammation", says Grawitz, "is the reaction of irritated and damaged tissues which still retain vitality." It is accordingly not to be regarded, as was formerly thought, as the product of some force animating matter from within, but rather as the sum of reactions to certain causes and tending always towards repair. Inflammation is accordingly not an entity which destroys, but really a process representing nature's efforts against destruction.

The uncomplicated head cold, confined to the nasal passages is technically an acute rhinitis or coryza; when the inflammation has extended to the adjacent cavities known as sinuses, we have then a sinusitis, designated as frontal, ethmoid, maxillary (antral) or sphenoid, according to the particular cavity involved; if the pharynx is the chief seat of cold, the attack is known as pharyngitis; and if the tonsils become involved we have tonsillitis. If the inflammation has gone lower down and attacked the larynx or voice box, the trouble is properly spoken of as a laryngitis; if still lower, affecting the bronchial tubes, we call it bronchitis.

It is in vain to imagine that this violent inflammation of the membrane lining the nasal cavity and of the spongy tissue lying therein, with its consequent intense engorgement of the blood-vessels, and over-activity of the different kinds of glands, with its copious exudation of serum into the submucous tissue, with its migration of leucocytes, with its over-production of mucus, with its desquamation or shedding of epithelia and in the later stages, with its formation of pus containing numerous pathogenic or disease producing bacteria,—it is in vain, I would say, to imagine that such a process is going to pass off without leaving some traces of its visit.

Undoubtedly, it has often injured these membranes, blood-vessels, and glands to such an extent as to permanently harm them, and in such a manner as to make them more liable to future attacks. Frequent colds, especially if neglected, set up a catarrhal inflammation. The latter predisposes to catching colds, and thus is completed a beautiful example of the "vicious circle."

Another evil feature of a cold is its dangerous tendency to extend. It is probable that every acute rhinitis or head cold is complicated with more or less involvement of the neighbouring sinuses, and if it so happens that certain conditions are present, an empyema or abscess may be the result. The inflammation often travels up the Eustachian tubes, and, in children especially, gives rise to a suppurative middle ear inflammation; or it may travel downward, setting up a laryngitis or bronchitis, or, in young children, a broncho-pneumonia. Add to this that in the suckling infant acute rhinitis has serious consequences, because of its interference with the taking of nourishment, and we have some idea of the need of preventing, if possible, or that failing, exercising our best efforts to cure this affection.

If we can regard the nose and throat as internal organs, it may be stated that they are the only ones which are directly exposed at the same time to the baneful influences of external conditions. The mucous membrane lining of the air passages, because of certain points of analogy, has sometimes been referred to as the internal skin, but compared to the thick epidermis, or cuticle forming the outer layer of the skin, the fine epithelial layer of the nasal membrane enclosing numerous blood vessels with thin walls must be considered as an exceedingly delicate and vulnerable structure.

Considering then, its delicate character, considering the importance and complicated functions which, as we shall see later, it has to perform, and considering that it has to come in contact with an atmosphere which we know is loaded with germs and grosser impurities, it should be no cause of wonder that disorders here are of common occurrence.

The serious nature of these affections of the upper air passages is not appreciated by those who consider only their immediate effects and their comparatively low mortality. The gravity of these disorders will be recognised as much greater when we consider their inherent progressive tendency and the serious ailments to which they may later give rise.

The importance of the functions of the nose and throat are not fully realised until they are injured or destroyed by pathological conditions.

Of the special senses, two, taste and smell, have their seat in these organs, and a third, hearing, is located in such close proximity that it invariably suffers from nasal and pharyngeal disease. In fact it is well understood that deafness has its origin in a great majority of cases, in catarrhal disease of the upper air passages.

The serious and far-reaching effects upon the general organism which must result from an interference with the respiratory function of the nose, we will discuss later.

Taste, smell, and hearing are the functions concerned with the perception of external impressions which are utilised by the intellectual centres of the brain for the formation and development of ideas. These vital avenues of sensation, which connect the mind with the external world, cannot be severed without great detriment to the individual, considered as a social unit in his relation with his fellow men.

Another important function which is menaced by affections in the upper air passages is speech, a function which may be considered as a complement to those just cited, in that it serves to convey to the outer world the ideas formed and stored in the brain, through the natural avenues for the egress of thought. Speech is not merely a matter of voice, affected only by disease in the larynx or voice box. It is a composite product of the action of the palate, lips, teeth and tongue, and essential to its proper formation, at least to its pleasing character, is a normal condition of the nose and nasal sinuses. Hoarseness is a special symptom of a cold in the larynx, but a cold in the head makes the voice woody and non-resonant and interferes considerably with proper articulation.

There has been of late considerable missionary work carried on among teachers, nurses and mothers, with regard to the effect of adenoids and diseased tonsils upon the physical and mental growth of the child, so that now there is a pretty general recognition of the importance of these maladies. But new children are constantly being born, and inexperienced mothers, nurses and teachers are constantly being made, so that it is imperative not to relax in this most profitable educational campaign, but to continue to teach, lecture and demonstrate, so that we shall have fewer and fewer children growing up with stupid and misshapen faces, irregular and distorted teeth, with undeveloped chests, and weak lungs, probably more or less deaf, and generally anemic and poorly nourished, because of the presence of these growths in the throat.

Recent investigations tend to show that rheumatism and serious heart inflammations may take their origin from inflamed tonsils. In children inflamed tonsils make them a much easier prey to measles, scarlatina and other infections of childhood, and moreover, intensify illness and augment complications.

We have still left unsaid the various ailments and discomforts, which are the immediate results of diseased conditions of the upper air passages, the headaches, the throat soreness and the occasional horrible ozena, which may be such as to cause the unfortunate subject to be ostracised by his friends.

The third reason which we advanced for a hygienic study of nose and throat troubles is that they are in a large measure preventable. It is a fact that a very great proportion of such cases are due to ignorance of hygienic conditions and neglect of hygienic laws.

Many absurd, vulgar beliefs and false empirical practices still prevail with regard to the cause and cure of these maladies which have obstructed progress. If, in their place, we can institute a rational hygiene, if we can show, for example, the baneful influence of tobacco, alcohol, drafts and improper dress in causing these diseases, and the value of such factors as cold baths and exercise in avoiding them, much certainly will be accomplished in the way of healthier noses and throats, and incidentally sounder constitutions.

II

ANATOMICAL OUTLINES

The nose, as we use the term when speaking of its diseases, includes not only the external or visible portion, the nose proper, but also the cavities lying within, technically designated the nasal fossae. It is of course the latter that are important from a hygienic standpoint. They form a large wedge-shaped cavity, whose size, shape, and extent can best be obtained from the front view of the skull, when no fleshy external nose obstructs the view. (Fig. 1.) It will be seen to extend from a large pear-shaped opening on the front of the skull, called the anterior nares, all the way to the throat, with which it communicates by an opening called the posterior nares.

Persons who have never examined the nasal fossae in the skull, often labour under a mistaken impression of the direction of the nasal passage. They imagine that these cavities run upward instead of backward in a generally horizontal direction as they do. (Fig. 5.) The error is due to the fact that the nostrils open in a horizontal plane which suggests that the direction of the nasal cavities is at right angles to this, that is, upward. It is essential that this false impression should not go uncorrected, for should one under this false belief have occasion to apply a probe in the nose, serious, even fatal result might follow. Instruments directed upward might impinge against the thin sieve-like layer of bone (cribriform plate) separating the nose from the brain, breaking through which they would unfailingly enter the cerebral cavity.

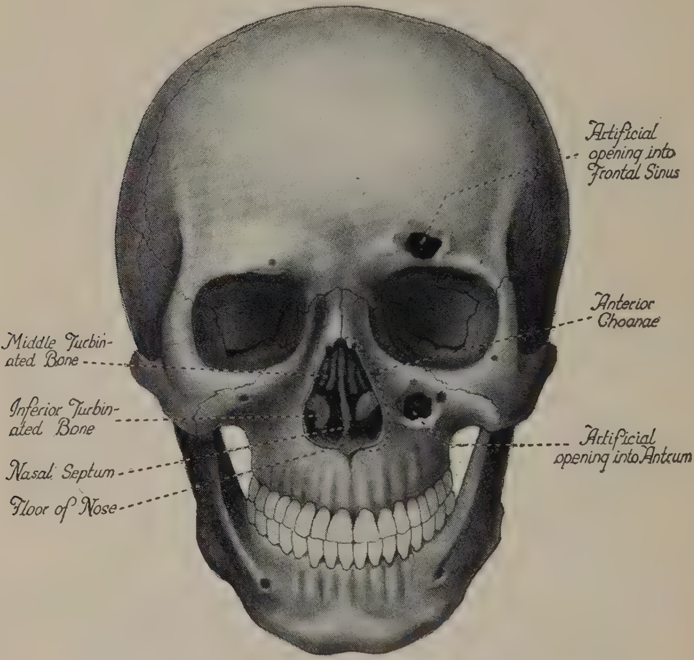

Fig. 1.—Front View of Skull

Artificial openings into frontal and maxillary sinuses (antra). Note the large pear-shaped opening into the nasal cavity with its floor running horizontally backward, indicating that the general direction of this cavity is backward and not upward.

The nasal fossae are divided into like halves by a vertical partition or septum, (Fig. 1) which, beginning at the nostrils, extends backward to the posterior nares, the place of communication with the throat.

The septum is seldom perfectly straight but is usually deviated a little to one side or the other. When the deviation is very marked it will tend to close that side of the nose to which it is inclined. Often associated with this, there may be considerable ridges formed along the angle of deflection, which constitute the so-called "spurs" on the septum. These spurs themselves sometimes constitute considerable obstruction and have to be removed.

Again, taking up the skull, we see jutting from the outer wall of each side of the nasal fossae, three fragile scroll-like bony shelves, running (from before) backward and parallel with each other. (Figs. 1, 3 and 5.) These are spongy bones, and what are meant generally when we hear of "bones being removed from the nose." But covered, as they are in the living, with flesh and membrane, they should rather be spoken of as turbinated bodies, or simply turbinals. These structures are of great importance physiologically and should never be removed except for the most positive indications.

Characteristic of these turbinals is the presence here of a special sort of tissue forming what are known as "swell bodies," or erectile tissue. The essential feature is a thick elastic network or plexus of veins which, according to need, will dilate and fill up with blood or completely collapse when contracted. This spongy or erectile tissue, which is necessary for the proper performance of the respiratory function of the nose, is found in greatest abundance on the lowest of the turbinal bodies, and less on the middle, while the uppermost one is practically free from it.

In looking into the nose of a healthy individual, only the inferior and middle turbinals are visible, and these not in their whole extent, for we view them as it were, "heads on," so that their "tails" are not visible from the front. But by introducing through the mouth a small mirror attached to a long shank it is possible with the aid of a good light to obtain an image of the posterior ends of all three turbinals.

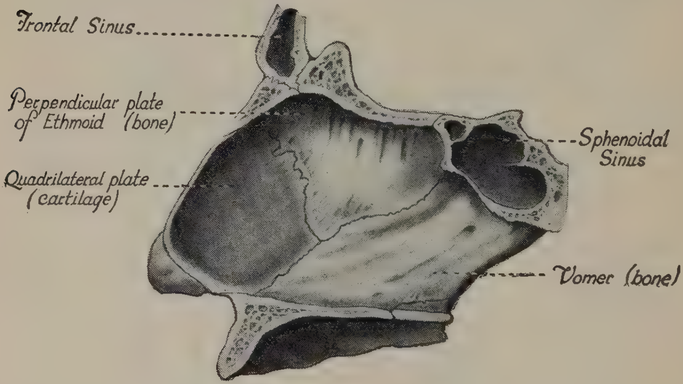
Frontal Sinus
Perpendicular plate of Ethmoid (bone)
Quadrilateral plate (cartilage)
Sphenoidal Sinus
Vomer (bone)

FIG. 2.—NASAL SEPTUM

The nasal septum, part bony and part cartilaginous, which forms the median partition between the two sides of nose. It is frequently bent to one side, usually as result of injury, causing undue narrowing on the side of its convexity.

A view of the transverse section of the head will show that surrounding the nasal fossae proper on all sides, and connected with them, are a number of other large air cavities, hollowed out of the adjacent bones of the face and skull. (Figs. 1, 3 and 15.) These are what are known as the sinuses or accessory nasal cavities which drain into the nose. They are very important because of their being the frequent seat of abcesses. These accessory sinuses are symmetrically disposed in pairs, those on each side being connected with their corresponding half of the nasal fossae by more or less constant and definitely located mouths of communication.

Just above the root of the nose, and extending upward, and outward to each side in the forehead are the two frontal sinuses. They are divided from each other by a septum into the left and right sinus. Back of the nasal fossae are also two cavities similarly disposed, called the sphenoid sinuses. On each side of the nasal cavities and lying between them and the eyes are a small series of cells which represent the ethmoid sinus, but because of the number and intricate disposition of the cells, called the ethmoidal labyrinth.

Of all the accessory sinuses the largest is the maxillary, called the antrum of Highmore. This capacious cavity occupies the hollow of the cheek. Its roof corresponds to the floor of the orbit of the eye, and its floor is in relation with the roots of the teeth, which often in fact penetrate into the cavity, and when diseased, may set up an abscess there.

The mucous membrane lining the interior of the nasal cavity extends through the little mouths of communication to line also the accessory sinuses, so that it is easy for disease to extend from the nasal fossae into the nasal sinuses or vice versa. The name "pituitary" meaning "phlegm producing," is applied to this membrane, because it is supplied with numerous minute glands which open on its free surface, some of which give origin to the secretions which are constantly present. The glands are of two kinds: mucous, whose

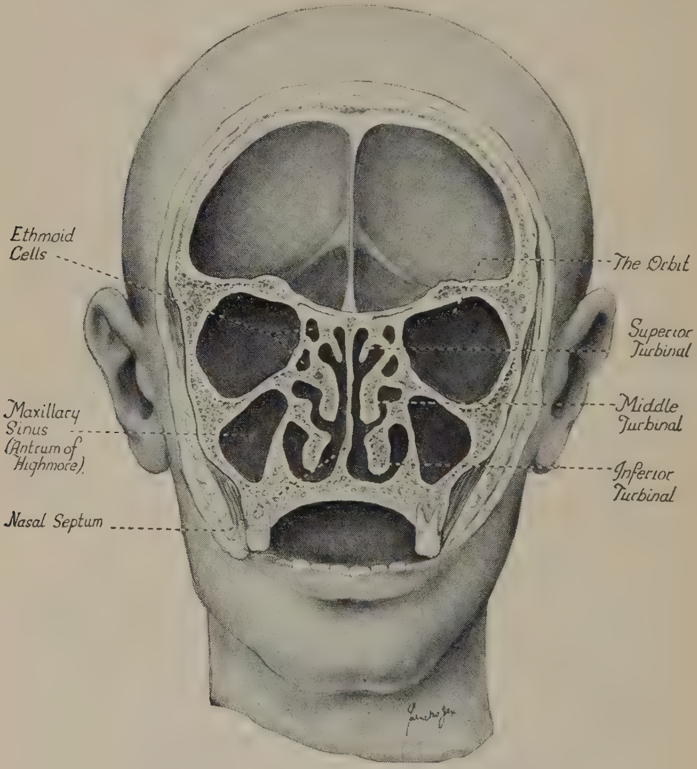

Fig. 3.—Cross Section Through Head

Section passing through nasal cavities, the orbit, and maxillary sinuses.

secretion is of a viscoid mucilaginous character, and serous glands, which secrete a thin watery fluid.

The nasal mucous membrane is very richly supplied also with blood vessels and nerves. The nerves are of three kinds, (1) sensory, those which have to do with common sensation; (2) sympathetic, those which have control of the veins of the swell bodies, and (3) olfactory, the nerve which serves the function of the special sense of smell.

First, the extreme sensitiveness of the nose, its marked irritability as shown by a tendency "to run" and give rise to sneezing upon slight provocation, is due to the generous distribution of nerves of common sensation.

Second, a small ganglion of the sympathetic system, Meckel's Ganglion, is situated in the upper part of the nose, to give origin to the so-called vasomotor nerves which control the plexus of veins constituting the erectile tissue. Those veins are surrounded by unstriped muscular fibres that will be found wherever muscular action takes place automatically and independent of the will. Responding to certain stimuli therefore, the vasomotor nerves of the nose acting upon these vessels will cause them to contract and dilate according to physiological needs.

Third, we have the olfactory nerve or special nerve of smell. Just before entering the nose it breaks up into a number of threads which perforate the roof of the nose by little openings in the cribriform plate and pass downwards to supply the mucous membrane. The olfactory nerve is not supplied to the entire mucous membrane of the nose, as some suppose, but to a very limited area in the uppermost part, much smaller, than is generally taught in most text books. This smelling area has been found to extend only as far as the upper margin of the middle turbinal, and a corresponding surface on the septum.

The post-nasal space or nasopharynx is the upper part of the throat, lying just back of the nasal passages. (Fig. 5.) It is particularly interesting for the reason that in its dome-shaped roof, we have a little tonsil (tonsil of Luschka), normally present in young children but often abnormally enlarged, then constituting the growth known under the name of "adenoids." (Fig. 10.)

On the lateral walls of the nasopharynx are situated the mouths of the Eustachian tubes, right and left, (Fig. 5) these being the pharyngeal orifices of the narrow air channel connecting this region with the cavity of the middle ear.

As distinguished from the nasopharynx, the part of the throat which we see when we look directly in through the open mouth is called the pharynx, properly the oropharynx. (Fig. 4.)

Still lower we have the part just back of the larynx, called the laryngopharynx, which continues on down into the gullet or esophagus, while the continuation of the air tract is represented by the larynx and the trachea, lying just in front.

Let us make clear what is meant when we speak of the hard palate, soft palate, and uvula, for, from remarks made by patients, it is evident, that these parts are very frequently confused. As we look into the throat, (Fig. 4) we see a sort of curtain suspended from the roof of the mouth, the lower borders of which form two half arches meeting in the middle. This is the soft palate, and its central downward prolongation constitutes the uvula. Together they mark the boundary between the pharynx and the mouth, the pharynx lying behind, while the term mouth may be applied to all that part of the cavity anterior. The soft palate is made up largely of muscle, as evidenced by the contracting action observed when the individual is instructed to utter the sound "ah," when the palate will become elevated and the uvula contract almost out of sight.

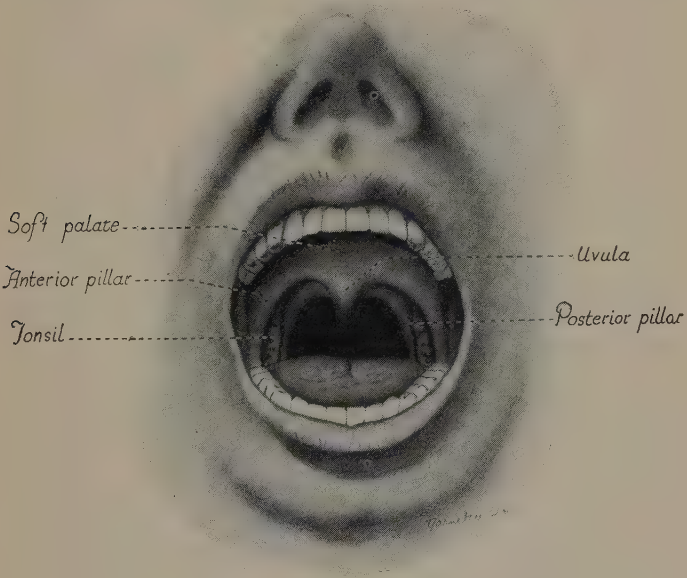

FIG. 4.—THROAT SEEN THROUGH MOUTH
Showing chief parts of throat interior.

The name hard palate is applied to the entire arched roof of the mouth, which is of bony formation. It is limited by the gums (alveolar process) in front and on the side, and ends posteriorly by a free border to which the above described curtain-like soft palate is attached.

The soft palate, as it stretches out toward each side of the throat, becomes divided into folds, front and back called respectively the anterior and posterior pillars. (Fig. 4.) Between these folds or pillars lie two very important structures, the tonsils, sometimes spoken of as the faucial tonsils, to distinguish them from the tonsil of Luschka, or third tonsil already mentioned. These structures when normal are small almond-shaped bodies about an inch in length and a half inch in width and thickness. Normally they do not project beyond the two folds between which they are situated, but they are very frequently enlarged from repeated attacks of inflammation, when they may reach such size as to come into contact with one another, almost closing the throat.

It may be mentioned that there is still another tonsil in the throat of which we do not hear much, but which, nevertheless, may give rise to some very annoying symptoms when inflamed. The fourth tonsil is located at the base of the tongue, just in front of the epiglottis or lid of the larynx, and is known as the lingual tonsil. (Fig. 5.) It is of special interest to singers and others who use the voice habitually since when enlarged it may give rise to hoarseness and other voice symptoms.

That part of the respiratory tube which is especially modified to contain the organ of vocal production is known as the larynx or voice box. To get a general idea of its plan of construction, imagine the top of the trachea or windpipe to be surrounded by a ring of cartilage, which is widened out posteriorly, and so bears a general resemblance to a seal ring, called the cricoid cartilage. This ring forms the support or basis of the other cartillages of the larynx. (Fig. 9.)

The whole front and sides of this organ are constituted by the thyroid cartilages, so-called from their fancied resemblance to shields. They consist of two great square shaped wings which meet in the middle line in front but open posteriorly.

Situated backward in the opening between these wings, and resting on the broad posterior or signet portion of the cricoid ring are two little pyramidal shaped cartilages, known as the arytenoids. These cartilages are of great interest because they are movable and, by their motion, effect the openings and closings of the vocal bands. Upon cross-section they are triangular, and the anterior end of the triangle is prolonged forward to form the so-called vocal process, to which the vocal cords are attached.

All the muscles of the larynx which move the vocal cords are attached to the arytenoids. Their action in opening and closing the cords will be described in the next chapter.

The epiglottis is the lid of the voice box. (Fig. 5.) It is a leaf-shaped plate of elastic cartilage, the stem of the leaf being attached in the upper part of the angle formed by the two plates of the thyroid.

The vocal cords (Figs. 7 and 8.) are pearly white bands, composed of yellow elastic tissue, running from before backward, and parallel with each other when closed. They are attached in front at about the middle point of the angle formed by the two wings of the thyroid. From here they run backward to be inserted in the vocal processes of the arytenoid cartilages. Their length in the male is about ¾ of an inch, and in the female slightly less.

Inasmuch as the anterior attachment is fixed, the openings of the cords can occur only by the movement of the arytenoids, to which they are attached posteriorly.

The slit formed by the separation of the vocal cords is called the glottis. It is of triangular form, the base of the triangle situated posteriorly being formed by the interarytenoid membrane (a membranous fold stretching from one arytenoid to the other), while the sides are formed by the vocal cords which come to an angle in front.

Lying above the vocal cords and to the outside, so as not to cover them, are two membraneous ligaments, to which the name "false cords" is given. (Fig. 7.) They have nothing to do ordinarily with phonation, though in cases of destruction of the true cords they can in some measure take their place.

The cartilages of the larynx are held together by ligaments and membranes, and the entire interior is lined by mucous membrane, which becomes very thin over the vocal cords.

The epiglottis and the ligaments binding it to the tongue, inasmuch as they can be felt by the finger thrust into the back of the throat, have sometimes been mistaken by nervous individuals for foreign bodies such as fish-bones or some diseased growth. In some persons by depressing the tongue considerably, a yellow gristle-like object may be seen riding up over the posterior edge of its base. This is a part of the epiglottis and not some terrible tumor in the throat as the inexperienced may imagine. In the coloured race the epiglottis is nearly always directly visible upon depressing the tongue.

The location of the larynx is easily recognisable on the outside of the throat. The large prominence very marked in some individuals, always more so in men than in women, and popularly referred to as "Adam's apple" (pomum Adami), is formed by the thyroid cartilage. The upper borders of the thyroid dip decisively as they approach the middle line. They can be felt as a distinct notch from the outside.

The nerve supply of the larynx is derived from the pneumogastric nerve. There is one branch which supplies chiefly common sensation, and another which governs the muscles which act upon the vocal cords. Of the manner of the action of these muscles we will have something to say when discussing the physiology of these parts in the next chapter.

III

NOSE AND THROAT FUNCTIONS

Nature, in its exercise of the hygienic function of protecting the organism against hostile and injurious elements, is nowhere so beautifully and so profusely illustrated as in the upper air passages.

The nose is usually regarded as an organ for breathing and smell, (respiration and olfaction). These are, indeed, the main positive functions. In addition, the nose performs important contributory duties to the functions of taste, speech, and hearing.

But let us contemplate for a moment its less conspicuous, though no less valuable, duties as a protector.

In the first place, the threshold of the nasal passages is supplied with a number of coarse hairs called the vibrissae. Their purpose is to catch the dust and larger particles floating in the atmosphere in order to save the more delicate mucous membranes beyond from being injured.

Next, observe with regard to the mucous membrane itself, the peculiar features of its protective character. Its acute sensitiveness is necessary in order that it may quickly become aware of injurious foreign bodies. The irritation of the latter produces attacks of sneezing, the purpose of which is to dislodge them. At the same time more or less copious secretions are stimulated, which bathe the membrane, and tend to wash away the offending substance.

Recent studies, moreover, have shown that these secretions possess bactericidal properties; they overcome and destroy the micro-organisms which have gained entrance to the nasal cavities. Again, the surface of the nasal mucous membrane is provided with myriads of fine hairs too small to be seen except under the microscope, and known as cilia. These keep up a constantly waving motion, which has the effect of sweeping out particles of dust and other foreign agents which may have gained entrance to the nasal fossae.

Both the olfactory and the respiratory functions, when analysed, will be seen to be designed in a great measure to protect the organism. The sense of smell has its esthetic side, and may often be the source of delectable sensations, but primarily its purpose must be acknowledged to be, to detect elements that might be deleterious to the organism, and warn against their ingestion or inspiration. In the lower animals this function is of paramount importance.

The rôle that the nasal organ has in the process of respiration is largely one of protecting the delicate air cells of the lungs from the known injurious effects of the air ordinarily found in nature. Unless this be warmed and moistened, as well as freed from impurities, it is unfit for the sacred precincts of the pulmonary or lung cells. The construction of the nasal organ is such that under normal conditions these tasks are well and properly done, and the lungs safely protected. In the throat and mouth cavities also, we may observe provisions essentially or incidentally protective. Taste is analogous with smell in enabling the individual to distinguish the beneficial from the harmful. The tongue, in addition to its customary function, is probably the most sensitive organ of the body to the sensations of touch and temperature, and is naturally of extreme importance in safe-guarding the digestive tract.

The palate with its uvular prolongation exercises a most useful, protective function in the act of swallowing. (Fig. 6-B.) By applying themselves tightly to the posterior wall of the pharynx, during the swallowing act, they close the upper, or nasopharynx cavity completely from the region below, and thus prevent food and water from passing upward and getting into the nasal cavity, and possibly also the Eustachian tubes. The value of this function may be appreciated when the palate, from diphtheria or other causes, becomes paralysed and the patient suffers with each act a regurgitation of food or liquid which may enter the nose and pass forward, and even out through the nasal cavities.

Very little is known of the function of the tonsils, but the one most generally ascribed is that of protecting the organism by way of phagocytosis, that is to say the power of its cells to swallow and destroy the numerous pathogenic organisms which are found in the oral cavity.

At the larynx, the last gateway which must be passed before entering the lungs, Nature, not to take any chances, has placed several special guards to protect against the entrance of unwelcome guests. If the latter have succeeded in getting by the foreposts stationed above, here they will meet new and more effective barriers.

First, the larynx is provided with a lid, the epiglottis, which aids in keeping food from getting into the respiratory tract, and in directing it back into the proper channel, the esophagus. If however, through mishap any particles get into the vestibule of the larynx, immediately such a violent contraction is set up, first in the false cords which are above, and then in the true cords, which are just below, that further intrusion is usually impossible. (Figs. 6-B and 8.)

The choking and suffocation which most of us have suffered at times, as a result of "swallowing the wrong way," is due to tight closure of the chink of the glottis from this spasmodic, persistent contraction of the cords. Finally, if particles get below the glottis, the irritation will produce mucous secretions, and a forcible expulsive cough, which are generally effective in dislodging them.

The olfactory function is, as we have indicated, of far less importance in man than it is in some of the lower animals, in which it is highly developed, and plays an essential rôle in the struggle for existence.

Since the filaments of the olfactory nerves, are distributed only to the uppermost part of the nasal fossa, called the olfactory fissure or chink, it is necessary for the air-borne, odoriferous particles to impinge upon the mucous membrane in this locality if they are to be smelled. This is done by the production of eddies in the current of the inspired air. The air does not pass through the olfactory slit in its passage outward. This fortunate provision explains why odours which originate in the throat arising from decomposition or digestive disturbances are not ordinarly perceived by the patient.

The act of sniffing, with which we are familiar in the attempt to obtain an odour, as when we would enjoy the fragrance of a flower, is readily understood in the above given description of the process of olfaction. Sniffing is an attempt to bring the odoriferous air quickly into the upper region of the nose, in the region of the olfactory nerve.

As distinguished from the olfactory, all the remaining part of the nasal cavity is sometimes called the respiratory fissure or cleft. The course of the air current through the nose will be influenced to a certain extent by the position of the nostrils and the general conformation of the nasal cavities, and by the effort in breathing, but it follows in general a very regular tract. The inspired air does not pass directly backward along the floor of the nose, but describes an upward curve and passes more or less over the middle turbinal, and then gradually downward to enter the throat through the posterior nares.

The work that the nose performs as an organ of respiration is of the most vital importance to the organism. The popularly prevailing conception of the nose is that it is an organ intended chiefly by nature for the purpose of olfaction (or smelling). It is thought of as being useful to smell with, not to breathe through, the latter function not being looked upon as at all peculiar to the nose, or at least of but secondary consideration. To this erroneous conception may be traced a lamentable indifference to certain of the most vitally important ordinances of nature. If through accident or diseased condition, congenital or acquired, the nose has become obstructed or disabled, it is supposed, in conformity with such restricted view of its physiology, that the consequence is nothing more than a certain inconvenience, and that, too, pertaining rather to the esthetic than the practical environments. On the contrary, we ought really to consider the olfactory function as subsidiary to the respiratory, in the sense that thereby we are apprised of the state of the atmosphere about us and warned as to what air we may or may not breathe.

The nose is eminently adapted, by reason of its structure to take a certain part in the great process of respiration, and a failure to so use it will entail upon the system irreparable damage. If an individual breathes constantly through the mouth instead of the nose he is guilty of a hygienic transgression for which he will have to pay a heavy penalty.

As an evil practice upheld by popular belief, though more difficult to correct, more imperatively demands correcting, and as physiology is the helpful handmaid of Hygiene let us now consider in particular the respiratory functions of the nose.

The nose has three important duties to perform, all of which are necessary as preliminary and prerequisite steps in the preparation of the outside air before it enters the lungs. These are to warm, to moisten, and to filter.

For this work it is especially qualified by the great expanse of its interior lining and by the fact that the latter is provided with a kind of tissue suitable to the purpose and capable of conforming to the varying conditions of the atmos-

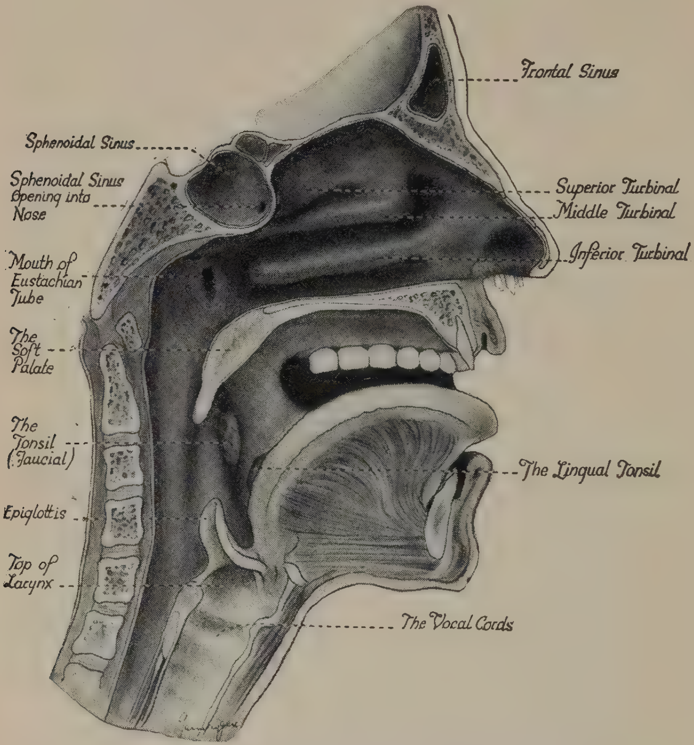

FIG. 5.—OUTER WALL OF NASAL CAVITY AND THROAT
Sagittal section through head to show lateral walls of nose and throat with chief structures there located.

phere. This is the cavernous or erectile tissue known as "swell bodies" (German, Schwellnetze) on account of its property of contraction and expansion to a marked degree as explained in the last chapter. It consists of a rich network of blood-vessels, interlacing in every direction. Under a nervous control extremely sensitive to the temperature environment, the nose is thus enabled to bring the air which passes through it in inspiration up to a nearly uniform standard of temperature, whatever may be that of the external atmosphere; and so the colder the air outside, the greater the work that is done by the nose. When the air is very cold, the membrane containing the cavernous tissue is stimulated, swelling follows due to the filling up of the blood-vessels, and thus an increasing amount of heat is given off to the air passing through.

Moisture taken up by the inspired air, like the heat, comes in great part from the nose, given off by the rich blood-supply here present. Before reaching the lungs, the air normally has almost reached the point of saturation, so that it is required to make no additional demands upon these organs. It has been estimated that in the course of twenty-four hours no less than 500 grams, or one pint of serum is given up to the air from the nasal mucous membrane.

The function of filtration is not the least important of the duties performed by the nose. Not only are particles of dust, noxious vapours, effluvia, and all sorts of inorganic substances arrested in their progress and prevented from entering the lungs, but so also, as recent research has proved, are the organic inhabitants of the air, the germs, the hostile bacteria, the disease producing cocci and bacilli, innumerable hordes of which surround us on all sides. While the grosser particles are caught either in the vibrissae (or coarse hairs) at the vestibule of the nose, or are taken up and thrown off by the glandular secretions, the other, the invisible elements, are combated in the nose by a bactericidal serum. Although we may find living germs in the vestibule in great number, upon microscopical examination they will be missed from the secretion taken from other parts of the interior of the nose.

Thus, standing at the threshold of the respiratory tract, the nose, rightly used, performs a guard duty of the most vital importance. It has a responsible protective rôle to play, failure of which means incalculable damage to the whole system. It is its place to act as a special barrier to the entrance into the lungs of all agents which may prove directly injurious to these organs, or, escaping thence into the circulation of the blood, give rise to manifold disturbances of health, including often perhaps the infectious fevers. Truly then, it cannot be considered extravagant to claim that it is the nose that gives to the inspired air the best right to the title of the "Breath of Life." Man may go for weeks without food, for days without water, but the limit of time that he can go without breathing is about four minutes.

In the Biblical account of the creation of man it is written, "into his nostrils God breathed the breath of life." Let modern hygienic science take note that it was not said "into his mouth," and in this instance admit it has no quarrel with revealed religion.

We can best appreciate what nasal respiration means to the health and life of man, when we know the damage done by its loss. This we must postpone until we take up the subject of mouth-breathing.

In addition to these direct principal functions, the nasal organ also plays a not unimportant rôle contributary to three other functions whose chief seats are elsewhere.

We refer to taste, hearing, and voice production. The nose through its olfactory function contributes a large and important part of the sense of taste. We usually think of taste as being wholly located in the tongue and palate. As a matter of fact, all that these organs can do is to appreciate the gustatory impressions produced by what is sour, bitter, salty or sweet.

All the other elements of taste, those in fact which may be called the refinements of this sense, and which make it a source of pleasure in the consumption of food and drink, take their origin in the function of olfaction. Without the nose we should wholely fail to recognise the subtle bouquet of the various wines; without the nose the delicate aroma of the coffee would fail to exist; without the nose there could be no appreciation of the delicious flavours of the various triumphs of the culinary art. Without the nose we would drink without zest, and eat without relish and though we had appetite, nothing would be palatable or savoury.

The word savoury illustrates the close relationship between taste and smell. It is derived from the Latin "sapere," meaning to taste, yet we apply it more frequently to what pleasantly affects the sense of smell. The savoury property of what is set before us is appreciated before we take it into the mouth, and it probably adds to the success of digestion as well as to our pleasure. For what is savoury stimulates the digestive juices, and promotes the digestive processes.

The nose plays a rôle contributory to the function of phonation or speech, which may be compared to its part in the function of taste. Phonation pure and simple takes place in the larynx, but if we could hear the sound produced by the vibration of the vocal cords, without the modification which is given it by the resonating chambers of the nose and throat, we should turn in disgust from its harsh, strident, unmusical, inharmonious tones. The quality of the voice, that which makes it resonant and pleasing, is due in a very great measure to the resonating chambers constituted by the nasal cavities and its accessory sinuses. It is from the supplementary vibrations in these spacious pneumatic cavities of the head that are produced those musical overtones which give the indescribable charm of both the singing and the speaking voice.

The nose is contributory to the function of hearing, only in the sense that it furnishes to the Eustachian tube the air which the latter in its turn conveys to the middle ear. A certain supply of the air thus furnished is necessary to the health and normal activity of this organ. How essential a free or open passage is to the auditory function may be readily inferred from the degree in which it suffers when the nose becomes, from any cause, obstructed. Nasal obstruction is regarded as a prolific factor in the causation of auditory disease. The simple experiment of swallowing with the nostrils held closed is sufficient to give anyone a personal illustration of the effect upon the ears of even a temporary nasal obstruction. An unpleasant sensation is immediately felt in the ear, due to the aspiration of the air from the tympanic cavity when the tubes are opened in the act of swallowing.

The part of the pharynx which we see when looking directly into the throat through the open mouth, the oropharynx, is peculiar in the fact that it belongs equally to and forms a part of both the respiratory and the digestive tracts, and must therefore perform the function of each. The oropharynx is, so to speak, the cross-road of these two tracts in the throat, (Frontispiece) and we ought not to be surprised that it frequently becomes diseased when we consider that it is exposed at the same time to the dangers and burdens incident to the respiratory and digestive functions.

The air tract begins with the nose, continues in the nasopharynx, then, intersecting the digestive tract in the oropharynx, passes forward to continue again in the larynx, trachea, and bronchi. (Fig. 6-A.)

The digestive tube begins in the mouth, and intersecting the respiratory tract in the oropharynx, passes back and downward to continue in the laryngopharynx, and then in the esophagus to the stomach. (Fig. 6-B.)

We have referred to the fact that the mucous membrane in that part of the nose which is designated as the respiratory fissure is covered with epithilial cells. Each of these cells contains minute waving hairs which are for the purpose of sweeping out dust that has collected on the membrane from the inspired air.

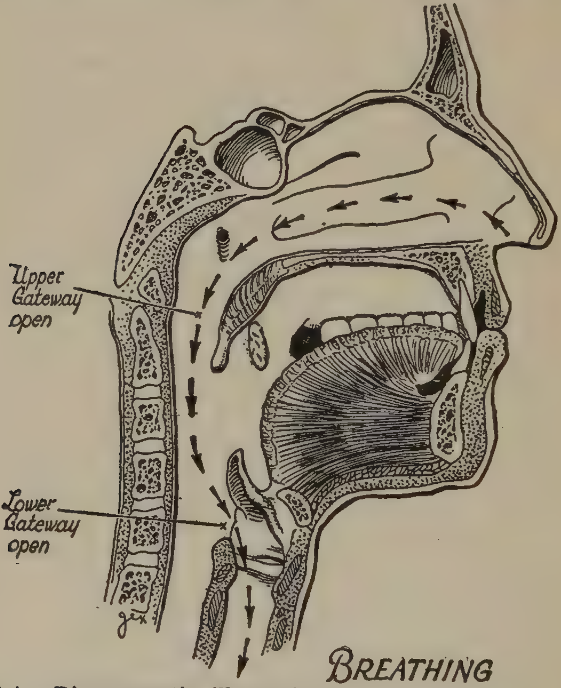

FIG. 6-A.—Diagrammatic illustration to show gateways of the throat open for the act of breathing. Arrows indicate course of air through the nose and nasopharynx over the crossways of the throat into larynx.

These ciliated, epithilial cells are peculiar to the respiratory mucous membrane. They are found also in the nasopharynx, which justly belongs to the respiratory tract. But, as we reach the oropharynx a modification appears, in order that this section of the throat may accommodate itself to its double function of digestion and respiration. Here the ciliated epithelia become replaced by flat epithelia of the pavement kind, the ciliated variety not being found again until we reach the larynx.

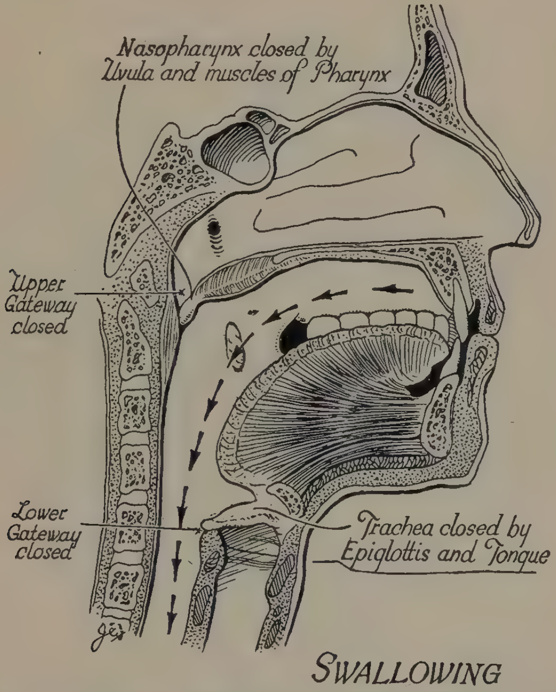
Nasopharynx closed by Uvula and muscles of Pharynx
Upper Gateway closed
Lower Gateway closed
Trachea closed by Epiglottis and Tongue
SWALLOWING

FIG. 6-B.—Diagrammatic illustration of gateways of throat closed for act of swallowing. Arrows indicate passage of food directly over crossways of throat into esophagus.

As the nose is the organ which stands guard at the head of the respiratory tract, protecting it from evil influences and preparing the air for entering the lungs, the mouth may be said to occupy an analogous position with regard to the digestive tract. The exquisitely sensitive tongue is quick to detect whatever is too hot or too cold, or what might be otherwise harmful to the stomach and by its manifold muscular contractions mixing the food with the secretions of the salivary glands, it prepares it for entering this organ.

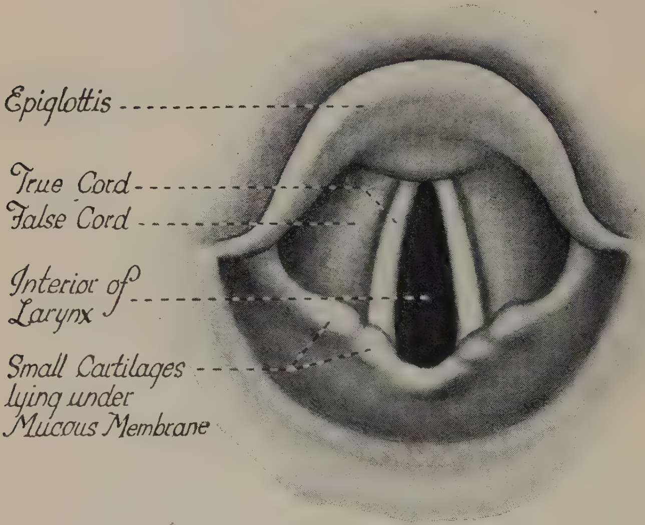

Fig. 7.—Vocal Cords, Open

The top of the larynx with its opening or glottis as it appears reflected from an illuminated mirror in the back of the throat (a laryngoscopic image). In the image the actual relations are reversed, with the back appearing in the front and vice versa.

When food or liquid is swallowed, the pharynx is automatically closed both above and below from its connection with the respiratory tract, to become at that moment a part of the digestive tract alone. (Fig. 6-B.) Above, the closure is, as remarked, effected by the simultaneous contraction of the muscles of the upper part of its posterior wall with the muscles of the soft palate.

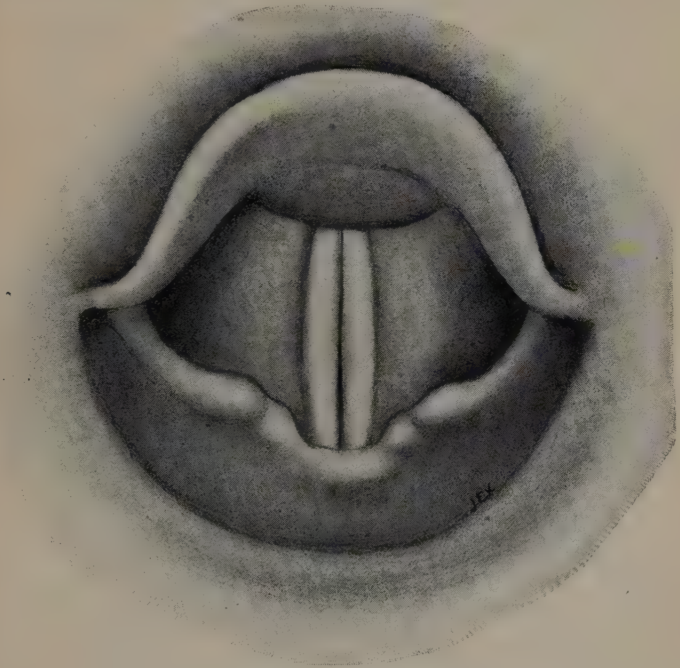

FIG. 8.—VOCAL CORDS, CLOSED

Same as Fig. 7, except that the vocal cords are approximated as in the act of producing sound.

The closure at the lower end is brought about chiefly by the depression of the epiglottis, acting as a lid for the larynx, assisted by a backward movement of the root of the tongue. Failure at this point may occur as a result of a severe ulcerative disease of the epiglottis and be manifested by a distressing paroxysm of coughing and strangling due to entrance of food into the windpipe.

The pharynx is continued downward by two separate tubes having different functions: behind, the esophagus or gullet for the passage of food to the stomach, in front, the larynx for the transmission of air to the lungs.

The larynx has, however, in addition to the breathing function, another very important duty, namely the production of sound for purpose of speech. (Figs. 7 and 8.) This is accomplished by the interposition of two little whitish bands, stretched across the interior of the larynx from front to back, and giving rise to tones by the vibrations produced by the current of air impinging on their free edges.

Variation in the pitch of the sound produced is accomplished by a group of muscles attached to and surrounding the cords, which by their contraction not only effect a closer approximation of the cords, but also a varying degree of the tension of their free edges.

As the congestion due to cold, spreading to the larynx, can easily involve these delicate structures and produce hoarseness and other voice troubles, it is interesting for voice users to have an intelligent understanding of the mechanism. (Fig. 9.)

The muscles which act upon the vocal cords may be divided into openers, closers, and tensors. Nearly all of them have an attachment to the movable arytenoid cartilages, whose form and situation we have elsewhere described. These two cartilages, the elongated internal borders of which

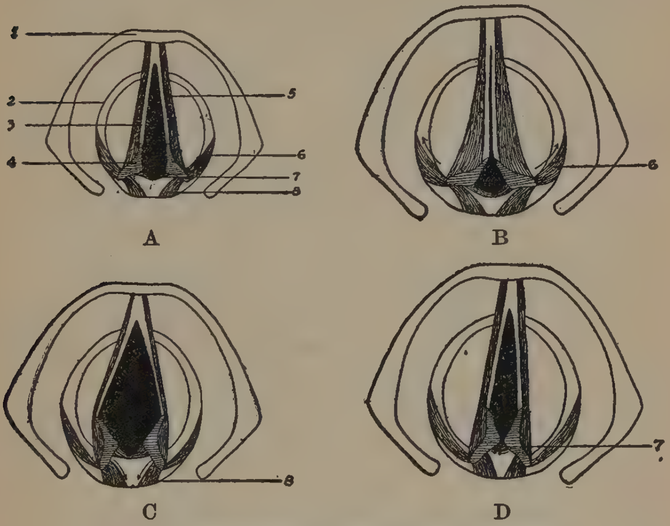

Fig. 9.—Diagrams of Vocal Cord Muscles

A schematic representation of the interior of the larynx showing action of individual muscles on the movement of the vocal cords.

A—showing muscles in the position of rest.

B—Illustrating the action of the lateral cricoarytenoid muscle, contraction of which produces approximation of the cords by inward rotation of vocal processes.

C—Illustrating action of posterior cricoarytenoid muscles, contraction of which opens vocal cords by causing outward rotation of vocal processes.

D—Illustrating contraction of interarytenoid muscle causing approximation of arytenoid cartilages.

1—Thyroid cartilages.
2—Cricoid cartilage.
3—Vocal cords.
4—Arytenoid cartilage.
5—The thyroarytenoid muscle.
6—Laternal cricoarytenoid muscle.
7—Interarytenoid muscle.
8—Posterior cricoarytenoid muscle.

form the small posterior part of the glottis, are capable of two kinds of movement; a sliding movement of the cartilages in toto toward each other, (Fig. 9-D) and a rotary movement upon a vertical axis. (Fig. 9-B and C.)

The rotary movement is effected by muscles attached to the so-called muscular process of the arytenoid cartilage which is the outer angle of its base. One pair of muscles have as their fixed point of attachment the broad posterior expanded or seal part of the seal ring (cricoid cartilage).

The effect of the contraction of this pair of muscles is to swing the anterior angle,—that part of the arytenoid to which the vocal cords are attached,—directly outward and thus to open the glottis. (Fig. 9-C.) This muscle which is known as the crico-arytenoideus posticus, or simply the posticus, is the only opener of the glottis. Directly antagonistic to this in action, is the crico-arytenoideus lateralis. Its fixed attachment is on the side of the ring of cartilage from which it runs upward and backward to be inserted into the muscular process of the arytenoid. The effect of its action is to cause its anterior angles or vocal process to swing inward toward each other and therefore to close the glottis. (Fig. 9-B.) To help close the posterior part of the cord, we have a little muscle running from one posterior surface of the arytenoid to its fellow, which upon contracting tends to cause these cartilages to slide bodily toward each other. (Fig. 9-D.) It is called the interarytenoid muscle. A muscle that is very intricate in its connection and whose action is not yet fully understood is one that runs from the thyroid to the arytenoid cartilages along the border of the vocal cords. It is exceedingly important in the function of vocalisation, and the general opinion is that it acts as a tensor of the cords. According to some authorities, certain filaments which are attached to the outer edge of the cord are for the purpose of modifying its elasticity. Acting according to this theory, now upon one part and now upon another part of the cord they can relax or tighten certain sections separately and thus have much the same effect as the stop action of the finger on the violin strings.

It remains to mention only one other muscle, the cricoid thyroid which is attached below to the front and sides of the ring cartilages and above to the lower border of the thyroid. The effect of its contraction is to increase the distance between the anterior and posterior attachments of the vocal cords and to act therefore as tensors.

IV

HIGHWAYS FOR THE INVASION OF DISEASE

To best appreciate the wonderfully constructed machinery of the body and to understand rightly the conditions of health and the causation of disease, it is necessary that man should be considered from a biological viewpoint.

The perfected organism of the human body is, in reality, the final product of nature's never-ceasing process of specialisation. Every animal organism is possessed with certain fundamental functions, including consciousness of its needs, the incorporation and assimilation of needed material into its own organism, and reproduction of its kind.

The lowest animal in the scale performs these functions no less than the most highly developed. The amoeba, for example, a simple one-celled animal, extends a portion of its body and seizes food that is nearby, and having no stomach eats with its entire body, and having no organs of reproduction, the entire cell divides for the formation of new ones.

As we ascend in the scale of development, we find that the organism is composed of a number of cells, and that their constituent units become differentiated one from another in structure and in function. In other words, just as people group together for the common good and organise a community, and just as it is found advantageous that certain persons in this community should engage in one kind of occupation or profession and others in others; so it is with the grouping of the cells to form the more highly developed living organism. The perfected human body must then really be considered as made up of myriads of unicellular beings, bound together for the good of the whole and dividing among themselves the various duties to be performed. A large group of cells for example have arranged themselves together to form a pouch, especially adapted to receive food and digest it; another group have become modified to the kind of cells especially fitted to perform the respiratory function, others become transferred into muscle cells and so on.

It is obvious, when we look upon the various organs of the body as so formed, that a very close relationship must exist between them, for the perfect working of the entire system is dependent upon the co-operation of the different parts. It is for this reason that disease in one organ is never limited to that organ, but is bound to produce disorder or ill health throughout the entire organism.

One of the important functions of a body politic is that it shall provide against the invasion of a foreign foe. Likewise with the great colony of cells forming the body. It was Metchnikoff who discovered that the little round white cells called leucocytes do police duty by catching and destroying the harmful bacteria which have gained entrance into the system.

But the policy of the cell as a sociologic organisation is to prevent invasion and as far as possible fortify against it. Accordingly, in harmony with her method of specialisation, nature has made certain cells specially flat and tough, and then spread them out into a great layer covering the entire body and forming its skin.

Every man is therefore surrounded by a sort of Chinese wall, and so long as no break or cut is made affecting its integrity, it imposes a fairly reliable defence against the hordes of bacteria which everywhere surround us.

But a way must be provided for the entrance of food and air; for the body cannot exist independent of the outside world, and must extract therefrom material necessary to its sustenance, growth, and development.

The nose and throat may be regarded as open ports for the entrance of needed material, and as such necessarily are attended with the danger that at the same time there may come much that is undesirable and harmful.

The act of respiration is not only an absolutely indispensable function of the body, but it is one of constant activity. Now if the respiratory tract were nothing more than a mere tube for the purpose of carrying the air to and from the lungs it might have a hard impervious lining like that of the skin; but there are important functions to be performed beginning with the nose, and to perform these functions we find the entire tract must be lined with especially constructed cells forming a soft, yielding moist membrane, of extreme delicacy.

Just beneath this thin vulnerable membrane are numerous glands and a rich network of blood vessels, which might easily be affected by injury and disease, upsetting their functions and giving rise to infection.

Has nature entirely overlooked this dangerously exposed area, this natural avenue for the invasion of disease? By no means, for realising the special vulnerability of this quarter, she has erected unusual lines of defence to oppose invasion. I invite you to the consideration of the protective mechanism. It is interesting, as showing how nature works.

A knowledge of these lines of defence is moreover of the highest hygienic importance, because good health depends upon our maintaining their integrity, whereas, their impairment and disability will surely lead to serious consequences. I believe that a great many people, if you ask them what the function of the nose is, replying rather thoughtlessly, would say that it is the organ of smell. But as noted in Chapter III, the most important and vital function of the nose is that of respiration. The air must not enter the lungs in the crude state, but must be warmed, moistened, and purified. It must be deprived of the injurious dust and germs with which it is habitually loaded, and for this duty the interior of the nose is particularly adapted by reason of the peculiar character of the structure of its mucous membrane.

Olfaction is of secondary consideration and we may say that the smelling organ serves its main purpose in apprising the individual of things which it might be harmful for him to breathe or eat. In some of the lower animals the organ of olfaction is very highly developed and is almost their sole dependence in enabling them to protect themselves against things that are injurious and to select what is beneficial. Man too, would often do well to obey the warning given him by his olfactory sense, and not breathe an atmosphere, whose stale, fetid, or otherwise offensive odour indicates its unwholesome character. We must realise then that the olfactory function, while still preserving its primary protective purpose, so important to lower animals, has become in man subsidiary to the more important function of respiration.

Nature's line of defence connected with the air passages begins just within the nostrils, in the part of the nose we call the vestibule. Here we always find a number of hairs or bristles, technically spoken of as the vibrissae.

Their purpose of course is to act as a sieve to entangle the dust and coarser particles of dirt, which would be deleterious to the respiratory mucous membrane. When injurious matter gets beyond the vestibule to the surface of the mucous membrane, other protective mechanisms come into play. The nasal passage instead of being a straight smooth tube directed backward, is in reality a more or less tortuous wedge-shaped cavity, divided by a median line into two similar halves.

Attached to the outer wall of each, as indicated in Chapter II, are three scroll-like bodies extending from the front horizontally and covered with mucous membrane especially thick in places.

The construction is such, therefore, that it tends to slow up the current of air and cause it to break into eddies, thereby facilitating the deposit of foreign bodies, as well as serving more efficiently to warm and moisten the inspired air.

The extreme sensitiveness of the mucous membrane lining the nose is another guarantee of protection. Anything of an irritant character will produce an extra flow of secretions which tend to wash it out and, in some cases, will provoke the protective act of sneezing. This consists of a paroxysmal expiration of air, driven through the nasal passages with a great force and an accompanying excess of secretion destined to expel irritant foreign matter.

But, of all the protective mechanism of the air passages, the most wonderful and interesting and at the same time the most effective is one which operates noiselessly and invisibly.

To the naked eye the lining of the nose appears as a perfectly smooth membrane; but if we cut out a section and place it under a high power microscope, we would find it covered with fine hair-like appendages, called cilia, which when the membrane is intact and healthy are in constant motion. The motion of each little cilium may be likened to the crack of a whip; in case of the nose the quick action always being backward as though to whip secretions toward the opening in the mouth.

In these myriads of cilia, forming together a waving field of hairs, we have a protective mechanism in the nose of the highest value in preventing injurious matter from gaining entrance into the lungs, and it accordingly is of great importance that all forms of catarrhal inflammation which might hamper the fine working of this mechanism be corrected without delay.

The watery secretion of the nose must also be counted as a part of its defensive artillery. In the first place, by entangling and dissolving solid particles brought into the nose with the inspired air, it greatly facilitates the disposition of these substances. In the second place, the ciliated motion of which we have just spoken is favoured by the moisture and warmth of these secretions, and, thirdly, the serum itself is directly antagonistic to the bacteria of disease. It is disputed as to whether or not the nasal secretions have actual germicidal properties, but it is generally agreed that they are at least unsuitable to the activities of germ life and accordingly prevent bacteria from multiplying and becoming virulent.

So much for the splendid fortifications of defence which have been erected in the nasal thoroughfare. Has nature staked her all upon these barriers, confident that they are invincible, or has she stationed others beyond? Dotted here and there over the mucous membrane of the throat, we see little nodules or hillocks. In certain locations we see tissue of a similar appearance heaped together in rounded masses. What are these large rounded masses and these little disseminated hillocks? They have certainly a suspicious look, for they suggest scattered or massed field pieces, a defensive artillery of the throat.

The smaller ones are disseminated nodules of lymphatic tissue while the larger ones are precisely the same tissue heaped together to form tonsils. As shown above, there are four of these tonsils, not just two as most of you perhaps are in the habit of thinking.

On each side of the throat between the folds which pass downward from the palate are placed the chief tonsils. These are the faucial tonsils and are those which are always meant when one simply speaks of tonsils without qualifications. (Fig. 5.) Hidden up in the vault of the throat just back of the nose is another, the pharyngeal, or as it is called, the third tonsil. This organ is particularly active in childhood and when enlarged constitutes the so-called adenoids of which you hear so often. (Fig. 10.) We will speak of them later. The fourth tonsil is at the base of the tongue and known therefore as the lingual tonsil; it is inflamed less often than the others, but may give so much trouble as to require removal. The sensation when it is enlarged is that of a ball in the throat, felt in the act of swallowing. The voice, especially the singing voice, is also often affected by the tonsils.

I know the question that is now in your mind and which you would like to ask me. If the tonsils are a part of nature's protection against disease, why do physicians almost universally recommend their removal? In answering this question, let me say that the tonsils are never to be removed simply because you have them. No physician should be guilty of recommending their removal, and no surgeon of performing the operation when those tonsils are seen to be normal, healthy, and capable of performing their functions.

No person should lose his tonsils without reason. But, unfortunately, a reason often exists. The truth is that the tonsils are seldom fully equal to the task which has been assigned to them. As barriers against disease they generally prove incompetent and go down with the first onslaught of the enemy. We need no further evidence of this than the microscope examinations which have frequently been made of the removed organ by expert pathologists.

We find them generally teeming with bacteria and often riddled with disease. The lymphocytes, the particular cells of these lympathic structures which endeavour to put up a fight against the invading army are overwhelmed by hosts of little foes and then all is lost.

The tonsils now instead of being a bulwark of defence are just the reverse. The bacteria swarm in the crypts, convert healthy places into diseased and favour the formation of pus pockets. These pockets are cess-pools of destruction, and recent investigations are proving more and more that herein lies a prolific source of many of the ills to which the flesh is heir. Toxins of all kinds produced by the various and more or less virulent bacteria in diseased tonsils, are constantly being absorbed into the system and infections of different kinds are the result.

Rheumatism and the allied disorders are now recognised as being of infectious character, chiefly due to toxins manufactured by the tonsils. Inflammation of the membranes of the heart (endocarditis and pericarditis) are infections which have been definitely traced to the same origin.

According to some authors even kidney inflammation can be due to toxins manufactured in a diseased tonsil.

However important might be the function of the tonsil when healthy, who would wish to keep an organ when it has become so diseased that it is not only incapable of its natural function, but on the contrary has become a Pandora box of infection and disease?

What we said of the faucial tonsils applies, though with modifications, to the others. The enlargement of the third tonsil constituting the so-called adenoids is attended with certain special evils due to its location. Situated as it is in the post-nasal space it cannot take on a considerable size without encroaching upon the posterior opening of nasal passages or upon the Eustachian tubes whose pharyngeal orifices are to be found on the two sides.

The Eustachian tubes are the ventilating shafts which pass from the ear to the throat. Any obstruction of these channels is a serious menace to the sense of hearing. If the obstruction persists, permanent impairment of hearing is to be feared. It is in children especially that these adenoids occur, and in them they are the chief causes of colds in the head. They are vulnerable structures, quickly and easily inflamed and tending to pass on the infection to neighbouring parts.

When the infection happens to travel up the Eustachian tube it is likely to produce an abscess in the middle ear; and the harm and dangers of a middle ear abscess would make a chapter in itself. Adenoid vegetations restrict nasal respiration and make of the unfortunate child an habitual mouth breather.

This brings us to say something of the general evils of nasal obstructions which may be caused not by adenoids alone but by various diseases, growths and malformations occurring within the nasal passage. We have referred to the important function of the nose in preparing the inspired air by warming, moistening, filtering and purifying it, so that it shall be fit to enter the sacred precincts of the lungs. When the current of air becomes deflected from its natural course and has to pass through the mouth, these important, vital functions are suspended, because the membranes of the throat are not competent to perform the same duties.

The mouth is, justly speaking, the gateway of the digestive tract, and is no more a proper passage for air, than is the nose a proper passage for food. Indeed it can be said that it would hardly be less physiological to practice eating through the nose than to indulge regularly in the habit of breathing through the mouth. When the inspired air is deprived of the benefit of the nasal functions, it reaches the lungs in such an unfit condition that the process of the oxygenisation of the blood is very imperfectly performed. This accounts for the anemia and malnutrition from which mouth breathers are universally observed to suffer.

The whole respiratory tract below the nose suffers in consequence of mouth breathing. The air, attempting to get the moisture and warmth required, works havoc upon the membranes of the throat, making them dry, glazed and parched, and the constant deposit of dust and irritant substances is certain to give rise to chronic catarrhal inflammation of the pharynx and tonsils, and also of the larynx, windpipe and bronchial tubes. These parts become naturally much less resistant, and are frequently the subject of colds, and it cannot be denied that the lungs in such a case are more likely to become a prey to tuberculosis.

Many people do not realise the importance of the respiratory act. Even a slight narrowing of the passages should be looked upon as a serious handicap, for when it is considered that one breathes at the rate of 26,000 times in 24 hours we must realise that the sum of the accumulated loss, however slight, will soon mount up to a great total.

In spite of a difficulty in getting sufficient air by way of the nose, one can generally practice nose breathing by an effort of the conscious will; but during sleep when the muscles are relaxed, it only requires a slight difficulty in the passage of air through the nose to make it take the easier way through the mouth. One may safely conclude that such is the case if he, regularly in the mornings upon waking, finds that his lips are parched, his tongue coated, and his throat feels dry and sticky.

We cannot stop now to describe or even enumerate the various conditions which may be responsible for nasal obstruction. The most frequent are nasal polyps, hypertrophy of the turbinal bodies, bony outgrowths from the septum and septal deviations.

Disease of the nose not of an obstructive character may give rise to grave disorders of the general system, no less than obstructive lesions. If, for example, there exists such an advanced catarrhal affection of these organs that the membranes are constantly covered with a thick tenacious secretion it is evident that even though the air may traverse the nasal passages unimpeded, the functions of the membranes will be just as much in abeyance, as if obstruction existed.

Catarrhal affections must be reckoned as more or less injurious to the general health in proportion as they subvert the normal nasal functions. Furthermore, most catarrhal troubles will tend to hamper the natural mechanism of defence, giving easier access to various sorts of infection.

It is generally believed that the micro-organisms of cerebrospinal meningitis find their way into the system through the nose, and there is reason to suspect that whooping cough, measles and scarlatina may originate in the same way. It has been estimated that fourteen thousand bacteria enter the respiratory tract with every breath, which would mean something like four hundred million in the course of 24 hours. Is it not rather a wonder that infection can be avoided at all, than a cause of surprise that it sometimes occurs?

As careful bacteriological examinations frequently have shown, the interior of the mouth and throat of even healthy persons regularly contains numerous bacteria most of them it is true benign, but some of them of a malignant type.

They will remain inactive as long as healthy local conditions prevail and the person's general resistance is kept at par. But let one be exposed to unfavourable weather conditions, such as will tend to produce a congestion of the nose and throat, and let the individual be at the same time in a general run down condition, how quickly a cold develops and these bacteria become active and virulent! Many of the infectious diseases of both childhood and adolescence have their beginning in the rousing to activity of the dormant bacterial flora of the nose and mouth.

Can one trust to antiseptic mouth washes, gargles, nasal douches, and sprays to keep the nose and throat free from germs and thus prevent colds and infections? No doubt they help in certain circumstances and when properly used, but to rely upon such measures solely and absolutely is faulty hygiene.

Antiseptic solutions may destroy the most superficially lying bacteria but they do not reach those which have penetrated the deeper layers and they do not correct the pathological alterations in the membranes themselves. There is indeed harm rather than good if the antiseptics used are of such character and concentration as to irritate the membranes, especially the delicate membrane of the nose, interfering with the natural processes of protection and repair.

We should not close the subject, without some reference to another subdivision of the upper respiratory tract, namely, the larynx. When we were discussing the functions of the nose, we emphasised the fact that the nose was not primarily an organ of olfaction but of respiration. Now in regard to the larynx or "voice box," it would be similarly putting the cart before the horse to say that the windpipe was placed in the throat primarily to subserve the purpose of a speaking organ.

Here again we should realise that breathing is the paramount function and the windpipe therefore must, first of all, be regarded as a part of the respiratory tract. And just as nature could so nicely utilise the nasal passages as a location for the olfactory organ, so again what more appropriate place could be found than the windpipe for the location of the vocal instrument.

The lungs acting as a bellows furnish the necessary blast of air which, passing up the tube, can be so well utilised for throwing into vibration the little bands stretched across the tube at this point. These bands by the action of certain small muscles can be placed through the different degrees of approximation and tension appropriate for producing sounds of varying pitch.

We may not be able to go as far as to say with regard to the larynx as we did of the organ of smell that its purpose is primarily for prōtection in connection with the respiratory functions, but we will call your attention to the fact that nature has not failed to make use of the opportunity afforded to establish in the narrow path formed by the vocal cords, another means of defence.

The vocal cords not only are approximated or brought together for the purpose of speaking, but also for coughing, giving thereby greater expulsive force to the expiratory blast of air coming from the lungs. The coughing act is always excited by the intrusion into the lower passage of irritant foreign substances, for the driving out of which a cough is no less effective than in getting rid of diseased products or secretions formed within.

The spasm of the vocal cords, shutting off the breath and giving a sense of suffocation, which many of us have experienced when we have had the misfortune to swallow something the wrong way, is likewise a protective phenomenon. It is nothing more than a violent contraction of the muscles of the vocal cords, intended to prevent the entrance of harmful substances into the sensitive air passages below.

V

PREDISPOSING CAUSES

That universal plague, which we call the common head cold, stands to-day as a mockery and a reproach to our boasted civilisation. It has steadily increased in spite of it, probably indeed as a result of it.

Modern medicine with all its triumph over disease has to confess itself impotent to prevent its occurrence and stem its progress, and this has seemed to have inclined the profession to assume an ignoble attitude of indifference toward this malady, as one too trivial to be worthy of its dignified consideration.

When, however, we reflect upon the frequency of its occurrence, the extent of its distribution, the possibilities for harm in its complications and consequences, we are forced to a realisation of the fact that it is an affliction of greater importance to the health, happiness, and efficiency of mankind, than many of the rarer and more dreaded diseases.

As noted in the Preface, when we compute the losses as measured only in economic values, from this wide-spread malady, we find that they reach staggering proportions. It is unfortunate that the profession manifests so little interest and neglects scientific study of this disease, for the uninstructed public, left to its own devices, wanders in a maze of ignorance, holds to archaic ideas, and concocts fanciful theories of its origin, nature and cure.

The pathology of the day of Hippocrates is still perpetuated in the commonly used French name for head colds, *rhume de cerveau*, derived from the idea that the excessive discharge is of cerebral or brain origin, just as the name of pituitary body, perpetuates the false pathology that this organ is the source of the pituitary or nasal mucus.

Pliny, one of the most learned of the ancients, and deeply versed in oriental lore, announced with the finality and conviction born of acknowledged authority: "I find that a cold is checked by any one who will kiss the nostrils of a mule." I am sure, if he could make the same announcement to-day and get sufficient publicity, that he would at once have faithful followers, expert in the practice and enthusiastic in the preaching of this queer doctrine.

To understand a disease so that we can successfully treat it, we must have an accurate knowledge of its pathology; to understand a disease so that we can prevent it, the most essential thing is to have a complete knowledge of its cause.

We are here concerned especially with the latter requirements, but in any case we should begin with an intelligent understanding of the nature of the disease in question.

It is not the disease which we should fear but its causes, and the prime need of medical science is to seek out and to give each its due weight and interpretation, never, unfortunately, such an easy business, because causes are always numerous, and modify one another greatly in their operation.

We have thought that a logical classification of the causes of colds might be made as follows:

1. Direct (Exciting) Causes.
    a. Bacteriological
    b. Meterological

2. Indirect (Predisposing) Causes.
    a. General
    b. Local

A word with regard to the direct or exciting causes of colds.

We are of the opinion that in recent years an over-emphasis has been placed upon the rôle of micro-organisms in the causation of colds and as a consequence of this, an over-dependence upon the use of vaccine and local antiseptics in their cure. We hold that colds are directly superinduced by the joint action of micro-organisms and of certain unfavourable atmospheric factors and that one is as necessary as the other.

It seems very unreasonable to exclude the atmospheric factor in the causation of colds in the respiratory organ, for the latter was created especially to deal with our atmospheric environment and we should naturally expect it to be influenced by it, just as the eye is influenced by light, the ear by sound, and the stomach by food.

Furthermore, the nose is particularly designed to react to humidity and temperature, the physical properties of the atmosphere which have most to do with causing colds.

We protest therefore against the too exclusive bacteriologic theory of colds, because, in addition to what we have already noted, this theory has been responsible for a certain tendency to place too little reliance on general health and body resistance, and on the various causes which we would designate as predisposing.

The search for predisposing causes of colds goes back into the early life, environment, and habits of the individual; we must ascertain when the predisposition began to be formed, and this consideration is of vital importance, because it may give the key to the question why we catch cold. We are all constantly exposed to inclement weather, and the micro-organisms we have constantly in our midst. Why does one person contract cold and the other escape, exposed to the same conditions? Because in one case the soil was favourable, and in the other not. The prevention of colds is therefore never accomplished by expedients of the moment; it can only be assured by years of earnest devotion at the temple of Hygeia.

When a patient appears before us and complains that he is very subject to colds, we inquire as to his exposure to exciting causes, and we review all possible predisposing ones. For an individual case, this review is never a simple matter because the predisposing causes are numerous, complicated, and sometimes obscure. It is therefore the duty of the profession to broadcast such authentic information as it may have, so that the individual informing himself upon the subject in general may apply what best fits his own case, and profit by it.

We remarked in the beginning that colds are the accompaniment of our higher civilisation. The more artificial methods of life devised for ease, comfort, and luxury, by relieving nature of making the necessary reactions towards its environment, cause the human body to lose its birthright of vitality and vigor, and become soft, tender, and lacking in resistance. And so what we call the conveniences of life, are offset by their attendant hygienic drawbacks.

The overheated home in winter paralyses our heat producing mechanism, the ever present fan of summer upsets the cutaneous circulation, the automobile touring mania fills our air passages with dust, the rich and highly seasoned food overstrains the gastric and hepatic functions. In general, we eat too rapidly, drink too much, smoke too often, dress too heavily and work too hard. We exercise too little, get not enough fresh air, take insufficient sleep, rest too seldom, and have too few diversions.

For laying the foundation for future trouble in the air passages, there is nothing equal to overheated places of abode. Homes, shops, offices, factories, schools, churches, theatres, lecture halls, public conveyances, are generally heated above hygienic requirements, because so many people demand it and are dissatisfied unless an undue heat is maintained.

In England and the Continent we find people comfortable and content in a temperature 65 to

68 F., which hygienists have agreed upon as most salutary. In this country we find temperature maintained more often above 70 than below, quite often around 75 and 80, and at times even higher. It is inevitable that persons living habitually in such an atmosphere must develop an inertia of the heat regulating apparatus, a sluggishness of the skin circulation, and poor response on exposure to the stimulus of cold air.

The worst thing about confined air over-heated, is that such air is likewise over-dry, a very bad thing for the mucous membrane of the respiratory tract. Air has an increasing capacity for watery vapour with rising temperature. Air, that at a lower temperature had a proper humidity, has with heating come to have a relative low humidity and therefore is excessively and unhealthfully dry. With its increasing affinity for water, it abstracts water from the air passages, which places them under a severe strain, especially as the nasal function has become inactive and sluggish because of the heat.

The air of a room in which the ventilation is poor or which is occupied by too many persons may become vitiated by an excessive proportion of carbonic acid gas, derived not only from animal exhalation, but likewise from coal, charcoal, and other fuel burned, and in less degree from plant life. On the average, each man exhales about 5 gallons of this gas per hour, so that it has been estimated that mankind alone pours into the atmosphere one billion and a half tons of carbonic acid gas in the course of a day, to say nothing of that coming from plants, that from

from organic material, and that derived from the combustion going on in our houses, factories, etc.

Fortunately, in the outside air this gas which we call CO_2 diffuses so rapidly that little harm results, but in crowded places it may reach unhygienic proportions. Some hold that CO_2, *per se*, is not a dangerous component of the air when in excess, but that the harm of a crowded place is in the accompanying poisonous animal exhalations, and a still more modern theory is that ventilation is not at all a matter of the components of the atmosphere, but that the suffocation experienced is due to high temperature, humidity and lack of movement in the air. Whatever be the truth, we may always look upon CO_2 as a measure of the purity of the air. In the country, air contains on an average of 0.03 per cent, in the cities 0.04 per cent. If in any situation it reaches 0.06 we are breathing an unwholesome atmosphere. In work rooms, offices, schools, etc., there should be at least 1000 cubic feet of space allowed for every occupant.

If we have not permitted our senses to become dulled by long habituation, we are generally able to appreciate an unhygienic air without measuring it. We are conscious that it is close, stuffy, unpleasant to our olfactory sense and uncomfortable to our bodies. If we remain in it too long, we become restless, nervous, and irritable. The correction is simply plenty of fresh air without draft, and it is better from time to time to open all the doors and windows freely and permit complete change than to allow a small amount of air to enter for a long time. The cold fresh air has an immediate stimulating effect upon the circulation, as well as upon the respiratory passages, and we feel its invigorating effects at once on mind, body, and spirit.

Some persons are obliged to pass much time in a vitiated atmosphere, by the necessity of their occupation. This is true of those who are employed in the dusty trades,—masons, stone-cutters, railroad employes, etc.—or those in factories attended with fumes of irritating gas. Others are obliged to work in an atmosphere of cold and humidity, as employes in ice factories and cold storage places, some again in an atmosphere of high temperature and humidity, as in steam laundries.

Such persons develop regularly certain forms of catarrh and naturally acquire the local cause of lessened resistance to colds. They should change their occupations if possible, but they are not as much to blame as those who disregard these unhygienic situations and become indifferent, ending by having their senses so obtunded or dulled that they are not aware of them.

The arrival of the vacuum cleaner should be heralded as a great hygienic advance, taking the place of the broom and the old feather duster, which in the hands of the energetic house maid, so successfully filled the air with dust from the floor, furniture, upholstery and drapery. Unfortunately with the increased craze for touring, what we miss in the dusty room at home, we get with interest on the dusty roads abroad, helped by the velocity of the winds or the velocity of our travel.

There is no subject more important than dress, when considering the problem of the disposition to cold. The object of dress is primarily to economise the body energies by preventing undue loss of heat to the surrounding cold air. In performing this function there must result a certain restriction in the operation of nature's own automatic machinery designed for the same cause, and as inefficiency follows inaction, we then acquire a weakened heat-regulating vasomotor mechanism and a greater susceptibility to the effects of temperature variations. However, clothes we must wear, and all that we can do is to take care that they are suitable. We can see to it that they are neither insufficient nor excessive; not of improper material nor improperly worn.

The chief requisites for clothes from a hygienic standpoint are as follows: (1) they should be poor conductors of heat; (2) they must be efficient absorbers of moisture; (3) they must have permeability; (4) they should be of as little weight as possible; (5) they should allow unrestricted body movement; (6) they should not make undue compression on any part of the body.

Poor heat conduction is the quality of clothes necessary to proper warmth and therefore more important for winter weather and in cold climates. Air is distinguished for its property of conducting heat poorly, for which reason it is of great advantage that winter clothes be of a material which in the interstices may contain much air. Nature is known to make use of this physical fact in the construction of both the feathers of birds and the fur of animals. The winter fur of animals, it has been observed, differs from that of summer, not in density or amount, but in its greater porosity.

It is very essential that the clothes we wear next to the skin shall have a high degree of absorptive power, and with it the property of giving up the moisture readily but not too rapidly. Remember that about three pints of water are given through the skin daily, and in addition we have a considerable amount of oily material,—product of the sebaceous glands. When not promptly absorbed, the surface of the skin will become covered with a thin layer of oily substances mixed with scales and epithelia, which tend to clog up the excretory ducts and hinder healthy skin function. This indicates not only that clothes should have good absorptive powers but that they should be frequently changed.

See to it that no material is worn of such dense and impenetrable structure that it does not allow the air to penetrate to the skin, a very necessary condition. Leather, fur, rubber and such impenetrable goods should therefore only be worn for urgent reasons and never for a long time. They should always be discarded as soon as the necessity for wearing them has passed.

Care should be taken not to overtax the body energies by wearing clothes of great weight. It is not the thickness of clothes that gives it warmth, but, as pointed out, its weave and the porosity of its fibres.

That dress should never be worn so as to impede movement or make undue compression on any part of the body is self-evident. Fortunately, body lacing is not practised as in former days but we see instances of harmful compression from shoes, garters, belts, collars and hats. An excessively tight collar may so compress the superficial vessels of the neck as greatly to impede the circulation and give rise to marked collateral congestion evident in the mucous membrane of the throat.

In regard to a choice of material for underwear there is difference of opinion. Woollen is of all goods the poorest in heat conduction, and it is also a good absorbent. In cold climates, it is certainly best for the outer garments and for those much out of doors perhaps also for underclothes, but there is some disadvantage in its tendency to shrink and lose its porosity. Linen and cotton are not quite such poor heat conductors, but they have excellent absorbent properties and they readily give up their moisture,—linen a little more rapidly than cotton. They are accordingly probably better material for underwear in temperate and warm climates.

In the last year or so, silk has become a popular material for underwear especially with women, which we consider to be a rather fortunate thing, with the tendency of women to wear less clothes. While not equal to wool as a protector against cold, it has double the heat conserving value of cotton or linen. It also has some advantage over linen in that it absorbs and gives up moisture slowly and therefore there is less danger of chilling, when exposed to cold air after heavy perspiration.

We will mention only for the purpose of condemning it the habit of wearing fur caps, neck scarfs, mufflers, leather vests and the like. These special extra coverings only tend to bring about a greater softness of the parts so protected and so to give rise to the very thing they are intended to prevent.

Sudoriferous glands are known to be particularly numerous over the surface of the neck and feet, and therefore for physiological reasons we should especially avoid covering these parts with impermeable material. Unfortunately, we have no satisfactory substitute for leather as a foot covering, and we must continue to have this weak point in our lines of defence, the most common gateway for the entrance of colds.

Great emphasis is properly placed nowadays on the rôle of autointoxication and the influence it has in cold catching. The by-products of disordered metabolism (tissue changing) circulating in the blood give rise to constant irritation in the mucous membrane leading to congestion and preparing the way for infection.

It seems to be generally agreed that the most common dietetic error consists in the ingestion of excess of proteins with faulty elimination, giving rise to an excessive richness of the blood. The proper proportion of protein intake is about 10%, but the average person takes nearer 20% and not a few as high as 30%. We are giving good advice to the chronic cold catcher if we advise him to eat less meat and more vegetables. The meats especially to be condemned are sweet breads, liver, kidney and high games, and we should include in our prohibitive order the putrefactive cheese, and for some people tea and coffee.

Care must be taken that we allow sufficient vitamins, so important for the vitality and general well-being. This can be assured by a generous allowance of milk, yolk of egg, whole grain, and fresh vegetables. As in the case of clothes we more often err by wearing too much, than too little, so with food, it is more often excess rather than insufficiency that is at fault.

The author of "Paradise Lost" was a good hygienist as well as a great poet. Apropos of the subject, hear what he has to say:

"There is," said Michael, "if thou well observe
The rule of *Not too much*, by temperance taught
In what thou eat'st and drink'st, seeking from thence
Due nourishment, not gluttonous delight,
Till many years over thy head return;
So may'st thou live, till like ripe fruit thou drop
Into thy mother's lap, or be with ease
Gathered, not harshly plucked, for death mature."

So far the causes we have considered are all of external origin. There are some predisposing causes of colds, arising within the body, due to a disordered condition of some of the viscera, or to general systemic states. Any disease which tends to give rise to congestion of the respiratory tract indirectly makes the subject more susceptible to colds by creating a condition of lowered resistance in these parts. A leaky heart for instance, when not compensated, gives rise to a general passive congestion which includes the mucous membrane. Diseases of the stomach and the liver are also frequently responsible for an obstinate catarrhal condition of the respiratory passages. Disorder of the eliminating organs, kidneys, intestinal tract and skin are, above all others, those which have the most unfavourable influences.

There are many cases of catarrhal disease which require attention to the condition of the intestinal tract, rather than sprays and swabs; cases that would benefit more from a dose of calomel than from an operation on the septum. Too much stress cannot be placed upon the part played by the skin and its influence upon the respiratory tract—its influence for good, if the cutaneous circulation is active and responsive, its influence for evil if it is inactive and sluggish.

The nasal organs in addition to their olfactory and respiratory functions have certain duties to perform in connection with the heat regulating operation of the body. While about 78% of the heat of the body is eliminated by the skin, most of the remainder is eliminated by the nose, and in this capacity the latter organ must be regarded as a sort of adjunct to the skin, and therefore susceptible to and profoundly influenced from this quarter. There is in fact a close relationship between the blood supply of these two systems through the sympathetic nervous system.

The mucous membrane may also suffer from defective elimination as a result of sluggish skin with inactive glands, just as it suffers from poorly functioning kidneys and intestinal organs. An extra burden of elimination is thrown upon the respiratory membranes by the toxins which are not eliminated by the usual channels.

Various disorders of the blood itself may have to be considered as possible causes of colds. Anemia in its different forms, especially chlorosis, must be thought of, and it is well known that leukemia may give rise to various disturbances in the upper air passages. Finally we need only mention certain general body states (or dyscrasias), supposed especially to predispose to disorders in the upper air passages, and favour the tendency to catch cold. We hear most often mentioned the uric acid or lithemic diathesis, or the condition spoken of as status lympaticus or lymphatic diathesis, and more recently attention has been called to an especial peculiar irritability of the sympathetic and parasympathetic nervous system, in which hay-fever conditions are especially prone to develop.

We have now to consider those predisposing causes resident within the nasal passages themselves. Because of the presence of certain kinds of disease, or certain kinds of malformation of structure, the nasal organs become as it were, *loci minoris resistentiae*, or places of lessened resistance, falling thereby more readily a prey to attacks of fresh inflammation. A chronic catarrh is sometimes spoken of as a chronic cold while often, in fact, it is only the result of persistent and repeated attacks, each leaving as it were some souvenir of its visit by a residue of inflammation. Now since the chronic condition once established, in its turn, constitutes a *locus minoris*, predisposing to the acute attack, there is thus created that most dreaded thing, the vicious circle. How particularly urgent therefore the removal of these local lesions.

In children the adenoids are the most prolific causes of head colds. We do not need to press the point, as it is usually recognised by parent, as well as by a physician. A child who is almost never without a cold, while his nasopharynx is filled up with adenoid vegetation, becomes promptly a normal child in this respect immediately after their removal.

In the adult we hold the diseased sinus as more often responsible for attacks of acute rhinitis than any other cause. In the case of the ever-present cold, the cold that never seems to leave, or that too soon returns with added virulence, we may confidently look for a focus of infection in one of the sinuses,—ethmoid, maxillary or sphenoid.

The fault is sometimes with other kinds of lesions, especially obstructive lesions that give rise to pressure and interfere with drainage. It may be a deviation of the nasal septum, an outgrowth or spur formation on the septum; a polypoid growth, an enlarged turbinal, or some other condition. But whatever it be, if pathologic, it must be corrected in the cold-disposed individual, if we wish to cure him, having always at the same time in mind the general condition of the patient, and the fact that other causes may be present besides the one we see.

VI

ATMOSPHERIC FACTORS

There has been, in the most recent times, a tendency to deny the influence, or at least minimise the importance of atmosphere in the causation of colds. This tendency is but the outgrowth of the modern doctrine of the bacteriological causation of colds, for it seems to be one of the weaknesses of the usual habits of reasoning that the mind, dominated by one idea of the causation of a thing, can only with difficulty entertain a just appreciation of other causes.

The medical as well as the lay mind has become obsessed by the idea of colds being due to the action of micro-organisms. We find on the one hand an over-emphasis placed on the contagiousness of colds, and an over-dependence on the vaccine treatment and local use of antiseptics; while on the other hand, too little weight is given the matter of general health and body resistance, with an attitude of indifference or contempt for weather influence.

Frequently we read or hear that it is a mistake to suppose that colds have anything to do with cold weather, and that a draft cannot do harm because it is nothing more than a concentrated dose of fresh air which should be at all times welcome. But when we reflect upon our personal experiences, we know that a close or humid atmosphere gives us a sensation of stuffiness in our nasal passages. We have a vivid remembrance of the running from our noses on cold, bleak days. We feel obliged to associate with drafts the almost certain tendency to sneeze, and we have all had the disagreeable experience of a cold in the head, tonsillitis or laryngitis following some indiscreet exposure to bad weather conditions.

We are not, however, obliged to depend upon mere personal impressions and conjectures as to the effect of weather in the causation of colds. Tables dealing with a large number of cases of acute inflammation of the respiratory tract show an increase in the winter months, especially with cold, humidity, and high variable winds. The most impressive statistics I have seen are those of Professor Schade of Kiel, taken from observations in the German Army, just before and during the late war (Zeitsch f.d. gesampt. Medizin, Berlin, 1918-1919, VII, 275). His data are based on an analysis of three-fourths of a million cases of diseases of the upper air passages in the army during peace time, 1900 to 1912, and a more detailed study of 17,000 soldiers in the trenches of their western front in 1914 to 1917. The outstanding fact brought out was that those cases coming under the general appellation of "Colds" increased regularly with the falling of the thermometer, and there was striking parallelism in their number with the number of cases of freezing and frostbite. So-called colds were from two to three times up to seven to eight times more frequent in winter than in summer, and in the winter of 1916-1917, marked by excessive cold weather, the number was three times greater than in other winters.

Supplementing statistical proof of the influence of certain weather conditions, we have the evidence also of experimental procedures. Animals have been exposed to atmospheric conditions which duplicated those in nature supposed to be especially productive of colds. Lode's experiments were with animals infected with the pneumococcus, and with one-half of the body shaved. After being given a warm bath they were exposed before an open window. The result was infiltration of the lungs, which sometimes was even fatal. Durck got the same results with animals dipped in ice water, after having been warmed in an incubator. Flourens got pulmonary hyperemia and bronchopneumonia in birds after severe exposure to cold. Aufricht saw inflammatory changes in the lungs as the result of animals exposed to cooling process. Nebelthau and Zellisen got infiltration of the lungs, and in some cases pneumonia. Jezersk's experiments differed from those previously made, in that they were milder and more nearly approached our real experiences. He did not use such severe cooling methods, and did not withdraw nature's method of protection by shaving the animals. He found that by cooling an already moist, uncovered part of the chest in the case of rabbits or goats there occurred always some changes in the lungs, from simple engorgement to more marked disturbance.

All these experiments are supposed to have been conducted in a scientific manner, and comparison made with control animals, in which the atmospheric factor was omitted. Lode, for example, found in the case of his animals infected with pneumococcus, either subcutaneously or by the inhalation of the powdered culture, that the mortality was 85 per cent for the animals exposed to the cold, and only 12 per cent in those not exposed.

It is not necessary to deny the bacteriological causation of colds in our advocacy of the importance of the atmospheric factor. Both are essential exciting causes.

There are some very natural grounds for assuming an atmospheric influence. We live at the bottom of an ocean of air covering the whole surface of the globe to a depth of about 150-200 miles, having a total weight of five quintillion tons. Though it is immaterial to our senses except when in motion, physicists tell us that the air is made up of molecules the size of one millionth of a millimeter, so small in fact, that according to Kelvin, Maxwell, and others, one cubic centimetre contains twenty-one quintillion. These infinitely minute particles are in a constant state of turmoil, and the number of impacts to which each molecule is subjected is something like 4,700,000,000 per second.

We inhale a volume of the stuff, amounting, according to Professor Foster, to 2600 gallons in 24 hours; this is about 34 pounds by weight as against 5.5 pounds of food, liquid or solid, which is taken into the body in the same length of time. As above noted, we may go for a number of hours without water and for a number of days without food, but deprivation of air for only a few minutes, makes the difference between life and death.

Air is at the same time the most constant and the most variable medium, being constant in its chemical constitution, but exceedingly variable in its physical. The mixture of oxygen, nitrogen, and carbonic acid gas, of which it is composed, maintains a most remarkably constant proportion, but we need not to be told how greatly the air may differ in its temperature and content of aqueous vapor, and how suddenly these changes may come about.

Huntington, in his interesting work entitled "World Power and Evolution," goes back to the earliest geographical eras, to emphasise man's dependence upon climate, which he avers has been the most important factor in his evolution. The great development periods of animal life, he says, coincide with colossal climatic crises, the most noteworthy being the cerebral development which characterised the glacial period. Man, in his struggle against the handicaps of Nature, evolved into a being, dependent upon atmospheric environment, and in the end delicately adaptable to its variations.

To enable us to utilise this vital medium for the nutrition, growth and development of the organism, Nature has given us the respiratory apparatus. This apparatus consists of an elongated pathway, which we may look upon as an invagination or dipping in of the surface membrane modified into a moist, delicate lining and provided at each extremity with specialised organs. At its pulmonary or innermost end, we have the air cells concerned only with the chemical properties of the air. At the outermost, or nasal extremity we have the erectile tissue concerned only with its physical properties—its temperature and moisture.

Is it not axiomatic that any organ of the body is especially susceptible to the influence of the agent or medium to which it is particularly adapted? The eye, made to receive the rays of light, will be damaged by an effort to utilise poor light, or by ill-directed rays or excessive light. The ears will suffer from exposure to unnatural sounds. The stomach becomes disordered by abuse of the amount and kind of food put into it. Therefore, we may expect the air-tract to be injured by certain abnormal conditions of the atmosphere.

Let us consider especially the nose, because it is here that colds most frequently occur and nearly always begin. It is the nose that we have to consider as the special seat of a cold; its winter quarters, so to speak, in winter; its watering place in summer. Here, therefore, is the best place to study the phenomena of cold-catching.

It is the business of the nose as a respiratory organ so to modify the inspired air that it shall acquire a warmth and moisture acceptable to the lungs and suitable to the proper functioning of the organs. Irrespective of its temperature the external air is brought up nearly to body temperature, and irrespective of its state of humidity it is brought up to the point of saturation. This work is done as indicated above in the nose and is made possible by the presence of the so-called cavernous bodies, constituting the erectile tissue of the mucous membrane, a net-work of interlacing vessels embedded in fibrous tissue containing many elastic and muscular fibres. Innervated by the sympathetic nerve fibres, this erectile tissue, by virtue of its responsive vasomotor connections, can become suddenly congested and swollen or anemic and contracted according to the particular atmospheric need.

The nose, being that part of the respiratory apparatus especially concerned with the physical properties of the air, should be particularly affected by abnormal conditions of temperature and humidity. In its effort to adjust itself to the varying physical state of the atmosphere, it is sometimes put to a very great strain. The temperature of our environment may change not only from day to day, but even from minute to minute, when we add to the changes incident to nature those that are of artificial making. To go from an overheated apartment suddenly to the cold outside air, or vice versa, is to make no small demand upon the nasal organ in the way of climatic adjustment.

In the matter of moisture also, a very great burden is often placed upon the circulatory and evaporating function of the nasal organ in order to bring inspired air up to saturation. Leonard Hill, the great English physiologist, has pointed out that at 30 degrees Fahrenheit, a cubic foot of air holds 1.9 grains of watery vapour, and when warmed up to body temperature it holds 19 grains, and he states that in quiet breathing the ordinary individual breathes a cubic foot of air every four minutes.

Since we have learned in discussing the physiology of the nose that the outside air, no matter what its temperature, tends to be brought up to body heat, it is evident that every individual breathing quietly air of a temperature slightly below freezing, must in four minutes, loose from his nasal membranes the difference between 19 and 1.9 grains or about 17 grains of watery vapour.

Roughly speaking then, in one hour's time there would be a loss of about half an ounce of watery fluid. Taking active exercise it is said a man will breathe a cubic foot every 1-2 minute, so that under the circumstances the amount of watery secretion given off may be as high as 2 or 3 ounces, in the course of a single hour.

It is evident that a heavy task is sometimes demanded of the nasal functions, and we should be able to understand why the nose is especially liable to be affected by atmospheric conditions, considering the great strain it is sometimes put to, in adjusting itself to extreme temperature and humidity states and to sudden variations in these properties.

Better to understand the reaction of the nose to atmospheric conditions, it is necessary to consider this organ from still another standpoint. The nose, besides its functions as an organ of olfaction and respiration, has a certain rôle to play in the heat regulating mechanism of the body. In the performance of this function it comes into intimate relationship with the function of the skin, and it is necessarily responsive to stimuli reaching it from this source.

Man maintains a constant temperature within, notwithstanding the fluctuations of the outside air. His temperature does not rise and fall with it as does that of fish and amphibia. Heat regulation is a matter of heat elimination, not of heat production. The myriads of cells of the body, like minute furnaces, are forever producing heat which if there were no outlet would have the body in 36 hours at boiling point. Elimination is constantly in progress, but by means of its marvellous automatic thermo-regulatory mechanism, the body is made adaptable to changes of the outside temperature so that there shall not be an undue abstraction in the presence of extreme cold.

As stated above, the chief organ of heat elimination is the skin, which, by virtue of extensive surface circulation and gland supply, responsive to cold stimuli, may allow a great or small amount of heat to escape by the process of evaporation and radiation.

A certain definite part of this function of heat elimination is performed through the respiratory organ. In some of the lower animals the respiratory outlet is of great importance, as is evidenced in the panting dog after exercise. In man, about one-sixth to one-fifth of the elimination is through this outlet; 23-20 per cent as compared to 77-80 per cent by way of the skin.

This relationship varies with the temperature of the weather in a certain definite way. The colder the outside air, the less the elimination from the cutaneous surfaces and the greater from the respiratory tract.

When the external air is cold the cutaneous vessels contract, lessening the activity of the sweat glands, and hindering elimination both by radiation and evaporation. And it is during cold weather that the elimination would be naturally greater from the nose, because the nose in the performance of its respiratory function gives off more heat the colder the air.

We must assume an intimate relationship through sympathetic nerve connections, in order to have a regular co-operation in these functions. Lessened cutaneous activity means contraction of the superficial vessels and determination of the blood to the internal organs. Increased physiological activity of the nasal organs means quickened nasal circulation and greater need for a supply of blood to the vascular erectile tissues.

There is, therefore under ordinary circumstances, a nice relationship and apparently a perfect co-ordination of the functions of the nose as an adjunct to the heat regulating function of the skin, to its functions as an organ of respiration. Under circumstances of extraordinary weather conditions, these relations may be disturbed and these functions upset.

Climate marked by an air that is cold and dry is by universal consent most desirable. The heightened physiological activities of the nose under these circumstances, giving up equally increased warmth and increased moisture, conform precisely with the atmospheric conditions for air that is dry as well as cold.

In an atmosphere of low temperature and high humidity,—the cold damp air of most renown for its cold producing effects,—the respiratory function of the nose does not conform so perfectly with the heat producing function. The reason bad weather is bad is that the nasal functions are in a certain way bound up with the heat regulating operations of the body, and therefore under the influence of impulses originating in the skin.

The nose is responsive to atmospheric conditions, particularly to temperature and moisture, not only because of its respiratory functions, but also because of its heat regulating functions and in the latter instance, the responsiveness comes indirectly by way of the cutaneous organs.

It sometimes happens that the demands made upon the nasal organs in connection with the latter functions are in conflict with those of the former.

Just to what extent the nasal organs are dependent upon the skin for its consciousness of temperature variations, we are not prepared to say. The cutaneous surface, we know, has a well developed thermal sense, more marked, as Goldschneider has shown, for cold than for heat. Unfortunately, it is not provided with nerve end-organs for distinguishing degrees of humidity. The skin, therefore, is not capable of taking into account disproportions both in the temperature and the humidity of the atmosphere, and it so happens that the reactions upon the nose, arising from cutaneous thermal stimuli, are not always consistent with nasal respiratory function.

In the light of these facts, what shall we say about drafts and how explain their supposed influence in precipitating colds? Is there a rational basis for the widespread fear of a draft, or shall we regard the popular dread of it as a ridiculous obsession which should not be entertained?

A draft may be defined as a current of air at a lower temperature and greater velocity than the surrounding atmosphere, impinging upon a localised area of the body. It is the general opinion that it is particularly harmful to a person sitting quietly in a warm, stuffy room or in any place if the body is overheated, and especially if in a state of perspiration.

We believe that herein are given conditions which, according to our theory of cold-catching, we might well expect to bring about an attack In the first place, when the cold air hits a restricted area of an otherwise warm body, the effect is to interfere with nature's effort to bring about the necessary heat elimination by way of the skin. In the next place the cold air acting through the sympathetic nerves causes a determination of blood to the erectile tissues which is contrary to physiological needs, for the individual is at this time in a warm environment breathing warm air.

The result will be the congestion of a disturbed function and if the irritation continues, and the supplementary factors,—micro-organisms,—are not lacking, this must eventually result in a cold.

The avoidance of drafts we maintain, therefore, must not be considered as arising from an ignorant superstition, but rather as a very wise precaution, having a good scientific foundation.

From the atmospheric standpoint, the conditions favourable for contracting colds occur when the air felt upon the surface of the body differs in temperature from that breathed, particularly if at the same time, there happens to be an unusual disproportion between the temperature of the air and its relative humidity.

Cold is a more powerful stimulus than heat, and the cutaneous nerve end-organs sensitive to cold are more numerous than those for heat. Cold acts as a positive stimulus which sets up an active contraction of the vessels of the skin, in distinction from heat, which has a negative or passive effect and is attended by a distention or relaxation of the vessels.

We all concede the invigorating effect of exposure to cold weather and the wholesome, energising effect of cold baths. But in order that cold shall have these good effects there must be normal responses, good co-ordination of function and adequate reactions. Under these circumstances, the cold acting upon the cutaneous vessels causes their dilatation. And when there is increased supply of blood to the nasal organs, it is seen to be in exact accordance with the physiological needs. When, however, the cold occurs under the circumstances we have mentioned as especially conducive to colds, the determination of blood to the nasal organ is contrary to physiological requirements, and we have a passive congestion instead of the normal, active flow of blood.

This idea of the effect of cold in the causation of "colds" is quite different from the old theory often quoted, which explained them as due to the contraction of the cutaneous vessels driving the blood to the internal organs, including the respiratory tract.

Heightened functional activity demands increased circulation, which is a normal phenomenon; but the increased circulation of a disturbed function is abnormal and pathologic. It leads to stagnation, dilatation of vessels, with escape of lymph and, if sufficiently strong and long continued, leads eventually to inflammation.

An additional reason why cold may have an influence for harm upon the respiratory organs in the case of its long continuance, at any rate, is that the eliminative functions of the skin are in abeyance. Toxins circulating in the blood which usually find exit through the skin may seek elimination by way of the mucous membranes, which are thereby possibly irritated and injured.

The subject of the atmospheric influence in the causation of colds may be summarised as follows: The atmosphere as a universal inescapable environment has had always and still has a profound influence on all life. For the utilisation of this element in the life processes, the respiratory organs were developed. For the warm-blooded animals there is a differentiation of function in these organs, in that the distal extremities (air cells) are concerned with the chemical; the proximal (erectile tissue) with the physical properties of the air.

An organ becomes sensitive to the forces of the environment to which it is adapted, and in consequence is affected by alterations therein. The respiratory tract must therefore be affected by alterations in the atmospheric environment; and the nasal end of it, especially affected by alterations in its physical properties. It is exactly the physical properties of the air which are most variable, and therefore the nose has a great burden to adjust itself to these sudden and wide variations. That the nose, the most frequent site of colds, would be especially affected by changes of temperature and moisture, coincides with the generally accepted view that these are the kinds of changes in the atmosphere which especially produce colds. The nose is concerned with these physical properties not only as an organ of respiration but as an organ of heat regulation in conjunction with the skin. On account of the latter function it is brought into close relationship with the skin, through sympathetic connection, and this explains how it is readily affected by atmospheric impressions on the body surface.

Under ordinary conditions the nasal organ can adjust itself to variations in the physical properties of the atmosphere and perform its respiratory functions as a heat regulating organ, but it must be adversely affected and suffer in the event of unusual and unnatural relations between temperature and humidity.

Prolonged moderately low temperature, for example, is harmful because it affords no opportunity for wholesome reaction; excessive cold, because it paralyses the mechanism of reaction; low temperature with very high humidity, because the determination of blood is not then altogether consistent with physiological function; the draft, because unnatural conditions exist, which hamper the skin and the nasal organs in the performance of their functions, and disturb the harmonious relation which should exist between them.

VII

COLDS AND MICRO-ORGANISMS

It is a matter of more than mere theoretic interest to know something about what germs have to do with colds, for it is a subject intimately bound up with the question of whether or not colds are contagious and as to how valuable are antiseptics or vaccines in its prevention and cure.

It is a rather natural failing of the human disposition to welcome an opportunity to blame other persons for an ill which may have befallen us, and it happens therefore that many of us, in our satisfaction with having found some one whom we can blame for a cold, overlook indiscretions on our own part, which probably were responsible in a greater measure.

It is our contention that germs and certain atmospheric conditions co-operate in the direct causation of a cold, and that one factor is as indispensable as the other. We have already dwelt somewhat at length on the part played by the atmospheric conditions, especially because there has been of late a tendency to ignore this factor and to regard colds as solely of microbic origin.

That the micro-organism plays an important part is too well attested to admit of denial. On the ground of analogy the microbial nature of colds seems probable, because, like other diseases of this class, we observe that genuine colds are usually ushered in by a chill or chilly sensation, run a febrile course, and terminate spontaneously after a more or less definite duration. In favour of their bacteriological nature also is the general observation that colds are peculiar to populous communities, rather than to sparsely settled areas, occurring in the crowded cities with much greater frequency than in the open country. The infectious character is evident in the tendency to attack at one time so many members of a household, or of a community, assuming even at times an almost epidemic character.

St. Kilda's cold is famous in literature. On this sparsely settled little island of the Western Hebrides colds are almost unknown, except, it is said, upon the occasion of the visit of a ship, when all the inhabitants are stricken. Dr. Samuel Johnson, as quoted by Boswell, considered this such a preposterous story that he was surprised that a reliable historian would take any notice of it. Now, however, we have most authentic accounts of many similar incidents.

It is known that colds seldom attack persons who are roughing it in the open, on fishing, hunting or exploring expeditions, though exposed to every kind of inclemency of the weather, and it has beeen observed with regard to parties engaged in astronomical or other scientific work on the tops of mountains that they are usually entirely free for months at a time, only to be attacked on their return home.

One of the most convincing evidences that micro-organisms are necessary to the causation of a cold is the experience of arctic explorers. Nansen and his men in almost three years sojourn never experienced a cold, in spite of exposure to the extreme low temperature with severe hardships and deprivations. Sometimes after a fatiguing march they would have to sleep in frozen bags, which were thawed out only by the heat generated by their own bodies. Shackleton relates that the only time any colds occured in his expedition was upon the occasion of unpacking some boxes, containing blankets and other materials, that had been packed in London and not previously opened. Peary, who was often treated by the author for acute inflammation of the nose and throat, proving that he was not naturally immune, states that neither he nor his men were ever subject to colds while in the arctic region, but that on their return, as soon as they came to thickly inhabitated places, colds were of common occurrence.

Notwithstanding all the evidence that colds are of bacterial origin, a specific germ always present and certainly responsible for the common cold or rhinitis, has never been discovered. A number of organisms are usually found present in connection with severe cases, such as the influenza bacillus, the streptococcus, the pneumoccoccus, the staphylococcus, and the micrococcus catarrhalis. Certain physicians lay stress upon one, others upon another as the inciting cause. The opinion of the best bacteriologists however, is that these organisms are none of them specific for the disease, and that they are present merely as secondary invaders. This seems evident from the fact that they are not to be found in the beginning of the inflammation but only after it has lasted two or three days.

We might mention that in certain quarters the theory is advanced that the ordinary cold is due to germs of such minute size, that they cannot be seen at all under the microscope, and are, therefore, designated as ultra-miscroscopic organisms. Some very interesting studies are now being made in bacteriologic laboratories, which would seem to indicate that there are organisms of infinitesimal size, which may be present in a solution after it has been passed through a filter that ordinarily is supposed to remove all germs. The remarkable thing is that these ultra-microscopic organisms have a tendency to destroy the ordinary germ, a fact that is pregnant with hope, if test tube results could be applied without reservation to the human body, that they may sometime prove a valuable instrument for fighting disease, in which case the contagion of good health might become no less a reality than the contagion of disease.

The view that acute rhinitis is due to a filtrable virus, containing a certain ultra-microscopic organism has not been generally accepted, and the consensus of the best opinions to-day is that there is not a specific cause of this troublesome affection, or if there is, it has not yet been found.

Now to return to the practical questions which are closely connected with the bacterial causation of the common cold, we have this to say with regard to its contagiousness. We believe that while this question may be answered in the affirmative, the answer must be made with reservations, and accompanied by explanations. Colds are undoubtedly to be classed as infectious in the sense that they can occur only when certain micro-organisms present in the environment have gained entrance into the system, but exposure to such an environment will not give rise to a cold unless certain other conditions are present at the same time.

First and foremost of those conditions are favourable atmospheric causes, such as the sudden chilling of the body by a draft or otherwise, which, as we have indicated, can upset the neuro-vascular mechanisms in such a way as to directly affect the function of the upper respiratory system, especially the nose. But both of these direct causes may be present and still no cold occur if the patient's general health be good and his resistance not reduced as a result of certain general or local predisposing conditions. We think therefore, the danger of contracting a cold by merely coming into the presence of one who is already affected is much exaggerated, although one had best avoid this when fatigued, run-down, or otherwise below par.

For several years past, many sufferers from colds have been induced to submit to the use of the so-called vaccine treatment for the purpose of cure or prevention. Its results have been disappointing and it is rapidly losing favour as a therapeutic measure by physicians, but it is probable, as often happens in similar cases, that it will continue to be used by the public after the medical profession has entirely given it up.

Vaccines, notwithstanding the name, have nothing to do with vaccination and are not based upon the same principle. In vaccination, a living virus is employed to produce a modified form of the disease, which protects against the occurrence of the genuine attack in its more severe form, a method of treatment which could apply only to that class of disease in which one attack confers immunity from subsequent attacks. In the case of colds, no such immunity is ever observed; in fact it is generally believed that a person from having had a cold, is rendered more susceptible rather than less so.

Vaccines must not be compared with antitoxin, which is based upon a scientific rationale, and has proved one of the greatest triumphs of modern medical science. Antitoxin is a serum derived from animals already immune, or made so by injecting into their bodies the toxin of the disease in question. This antitoxin therefore contains the elements which the system elaborates to overcome a particular infection, and which when introduced into the human organism has an immediate effect in destroying the toxins of this infection.

Vaccines are nothing less than an emulsion of dead germs which must be of just the kind as that causing the disease for which they are administered. Their use is evidently based on the principle that the way to get rid of a disease is to give more of it, the explanation being that the additional dose stimulates the protective forces of the body to increased activity. But how do we know that we are not just nagging the cells of the body to a desperate effort that will end in their own destruction?

In the early days, when this line of treatment was first instituted, such possibilities were already recognised, and emphasis laid upon the necessity of determining whether the phagocytes which were to be stimulated were in what was called the positive or negative phase. This could only be done by painstaking biological tests which in latter days have been altogether discarded as too difficult and time consuming, and now vaccines seem to be given blindly and without any check than that of the patient's own uncertain clinical reactions to the treatment.

All cases of rhinitis are not the same, and there occur very often slight abortive attacks, the so-called cases of pseudo-rhinitis, which are destined to last a few hours and pass away. Furthermore, it must be remembered that acute rhinitis is by nature a self-limited disease, which, treated or not, has a definite duration usually ending in recovery. Disregard of these facts is responsible for many unwarranted claims of the efficiency of vaccines as a cure.

As to their value as a preventive agent, the conclusions often drawn are equally baseless; a patient who has taken a preventive dose, and for a few months finds himself free of a cold, is very optimistic during that interval of the benefit of the treatment, entirely ignoring the fact that such intervals are just as common when no vaccine has been used. And often enough it has happened to us, that some patient reports for relief of a cold, within a very short time, it may be only a week or so, after an intensive preventive course of vaccine injection. Of course, this latter patient will be pessimistic, but such cases do not seem to offset the optimism of apparent success of others.

To justify the employment of vaccines, containing millions of dead germs, it must be assumed that the live germs causing the disease which we aim to cure, have failed either to excite sufficient reaction, or else the wrong kind of reaction in the natural protective forces of the body. As regards the first, it is very difficult, as we have intimated, to judge Nature's efforts precisely enough to say that it needs or does not need reinforcement. It is really in the very severe types of infection that assistance is needed, because then the natural production of antigens is unequal to the excessive virulence of the infection.

It is in just such cases, that the use of vaccines seems the worst. The natural forces of the body are already exhausted and the addition of fresh stimuli could only have the effect of overwhelming them.

There is to my mind no better illustration of the philosophy of the situation, than that of a drowning man, struggling and calling for help. Your vaccine enthusiast would scorn to throw him a rope or give him a helping hand, but would push him further under the water, in order, he would no doubt explain, to make him increase his efforts to save himself.

In regard to the contention that vaccines might be indicated, not because the natural body reactions were inadequate, but because they are of the wrong kind, it is difficult to see the rationale of such an hypothesis. Is it not more logical to assume that the natural body reactions to the living organisms causing a disease would be specific for those organisms, that is, just of the right kind to overthrow them, than such as might be produced by dead germs, even though of the same kind, which have been sterilised and changed by chemical treatment or heat?

As we see the matter, if the vaccines used have an effect which is in some way different from that of the living organisms, it is a wrong kind of effect, and if it is the same, it is evidently only an undesirable augumentation of the hostile forces with which nature has already to contend.

To sum up then, the use of vaccines to prevent colds cannot be justified on theoretical grounds, because in the first place, the bacterial cause of cold is unknown, and in the second place, even if known it could not be expected to be effective, because a cold is not a self-immunising disease. Their use for the cure of the trouble is equally indefensible, as they cannot be expected to be more than an additional burden on the already overtaxed protective forces of Nature.

VIII

SYMPTOMS, COMPLICATIONS AND SEQUELAE

It seems almost superfluous to describe the symptoms and characteristics of a cold; for who is it that has not had an opportunity to become familiarly acquainted with them through the unwelcome process of personal experience? The most familiar experiences, however, are not always very analytically observed, and so with regard to the ordinary cold, we will find the information of the patient inaccurate and his judgment unreliable.

One of the commonest errors is to mistake a pseudo-cold for a genuine one. As a result of mechanical or chemical irritants there often occurs a congestion in the nasal membrane that resembles a true rhinitis, but is only of temporary duration, and does not run a typical course.

Many individuals too are subject to nasal affections which are classed as "vaso-motor" attacks. The nasal membrane develops a peculiar sensitiveness to a specific irritant, generally the pollen of plants or some albuminoid substance in the dust, and not infrequently the emanation from certain animals. The attacks are of a more or less paroxysmal character, marked by sudden swelling of the mucous membrane with discharge of watery secretion accompanied by uncontrollable sneezing. The paroxysm occurs in the presence of the irritant and disappears just as suddenly in case of its withdrawal. These cases are very closely allied to hay fever, but the latter is distinguished in its seasonal occurrence, generally about the middle of August, and persisting to the time of the first frost. Genuine hay fever is rather more violent in its manifestations, usually affects the eyes, and is not infrequently associated with attacks of asthma.

We must distinguish also from the ordinary head cold, attacks of sinusitis. A simple common acute rhinitis or coryza involves only the lining membranes of the nasal fossa, and its contained structure, the septum and the turbinals.

But surrounding the nasal fossa and connected with it by small openings or channels is a series of bone cavities lined with a mucous membrane continuous with that of the nose proper as more fully explained above in our chapter, Anatomical Outlines.

One or several of these sinuses can become acutely inflamed, usually by extension of the rhinitis. We may generally suspect that sinusitis has occurred when the symptoms are extraordinarily violent and persistent, and when the discharge is very abundant and of a yellow, purulent character, and especially coming more from one side of the nose than the other, or dropping back into the throat. There is apt to be headache and sometimes severe pain over the region of the sinus, but this is often absent.

Frontal sinusitis is inflammation of the cavity in the frontal bone just above the nose. It is the one which is usually attended by the very severe pain in the region of the eyebrows.

Maxillary sinusitis is inflammation of the sinus lying in the cavity of the upper cheek bone,—the antrum. It is the one most frequently affected, and often without pain at all, or only a little aching of the upper teeth in that region.

Ethmoiditis is inflammation of the series of little air-cells which constitute the ethmoid labryinth, lying just between the eyes; and sphenoiditis, inflammation of the cavity lying at the base of the skull just posterior to the nasal cavity. Inflammation of these latter cavities is known to cause serious involvement of the eyes.

The early recognition of sinusitis is of great importance, because, if not promptly treated and cured, it tends to become chronic, and cause the cold to persist or to return on slight provocation.

Sinus inflammation is not necessarily accompanied by pain, and the symptoms are occasionally obscure. Every case of cold therefore which does not seem readily to subside, or presents any of the sinus symptoms above mentioned, demands expert medical attention.

A competent specialist can immediately tell if a sinus is affected and which one, and can apply measures which will bring speedy relief, more easily done the earlier the case is seen.

A cold in the head or acute rhinitis is inflammation of the mucous membrane lining the interior of the nose, and like any other inflammation represents the reaction which takes place in nature's effort to ward off and nullify the damage of a severe and persistent irritant.

Nature's chief and most active agent of defence is the circulation. It becomes immediately prominent on the appearance of the exciting cause, the blood flowing to the part affected in superabundance, carrying nutriment to the tissue and myriads of white cells, or phagocytes, to devour and destroy the hostile germs.

In the beginning, the vessels are widely dilated and the circulation quickened, stimulating the cells and the glands, which in turn become active, producing abundant secretion.

As the fight thickens the circulation becomes, however, slowed, and white cells and the fluid escape through the wall of the vessels into the surrounding tissues. The nasal membranes will then be observed to present the cardinal symptoms of inflammation, viz., redness, heat, pain and swelling, and with them naturally disturbance and loss of function.

We have referred to the peculiarity of the nasal mucous membrane in the fact of the presence there of a mass of very vascular tissue called the erectile tissue. It consists of a great network of interlacing vessels which have properties of unusual expansion and contraction. When these vessels are distended the membrane, of course, becomes swollen, accounting for the stuffiness or stoppage of the nose in acute colds, and their contraction accounts for the freedom of the passages occasionally obtained. The escape of serum from the blood, together with heightened activity of the myriads of glands with which the membrane is provided, explain the abundant discharge which is inevitable. There is no acute pain in an ordinary uncomplicated rhinitis, but the inflamed membranes are extremely sensitive, and so intolerant of the slightest touch that sneezing is a frequent and sometimes annoying symptom.

Every head cold, in reference to its manifestation, has three stages; first the preliminary or dry stage, second the stage of watery secretion, and the third stage of mucous secretion.

The first may be of but a few hours duration, when one experiences a general feeling of malaise and discomfort and perhaps a slight chilliness or "creepy" feeling. At this time the nose may be a little full and stuffy but dry, and there is a tendency to sneeze.

The second stage is marked by copious watery secretions from the nose, and the general increase of constitutional symptoms. Following a chill or at least chilly sensation, there will come a slight fever, when the skin will be hot and dry, with headache, furred tongue and disturbance of digestion. At the height of the cold one's mental operations are always somewhat hampered,—there is lessened capacity to concentrate attention, with mental hebetude or irritability.

After a few days, it may be a week, this stage is succeeded by the third, the stage of mucous secretion. The acute symptoms now subside, to be replaced by a certain degree of general weakness and lack of energy. The secretion from the nose instead of being watery becomes thick and mucoid, at first white glairy, and then yellowish and sometimes with an admixture of blood. The nasal stoppage is less intensive and of less duration.

If a cold in the head be confined to the nasal cavity proper, there would be less to worry about, but unfortunately it manifests an uncontrollable tendency to spread. This is owing to the fact that the same membrane that lines the nose extends to the (1) throat, (2) to the surrounding sinuses, (3) to the ear, and (4) to the eyes, so that the inflammation naturally travels to these parts.

Some throat involvement almost invariably follows an acute rhinitis. This may be due partly to the nasal obstruction which causes mouth breathing, which is damaging to the membranes of the throat, and the lower respiratory tract, but for the most part it is due to direct extension, first to the post-nasal space, and then to the pharynx, tonsils, larynx and bronchial tubes. Nearly always it is observed that an acute tonsilitis or laryngitis has been preceded by an acute rhinitis, and then of course the duration of one's attack of cold is greatly lengthened and its seriousness increased.

We have referred to the tendency of sinus trouble to develop in connection with every severe acute head cold. Each sinus is in communication with the nose by some sort of opening or passageway, through which the mucous membrane extends into the sinuses and through which the infection naturally travels. All those severe intractable inflammations of the sinus, were first ordinary head colds. When there is much and persistent swelling of the mucous lining in the neighbourhood of the sinus openings these, by becoming closed, cause the sinus secretion to be imprisoned. Without aeration and without drainage the sinuses go from bad to worse, and collections of pus form in them, which, if neglected, may lead in time to serious disease of the bone (necrosis).

The inflammation from the interior of the nose can reach the eyes through the lachrymal duct, a duct formed for the outlet of an excess of tears. Conjunctivitis or pink eye is a common complication of a coryza, and often will not be cured until the nasal trouble is corrected.

The danger of ear involvement is ever present in connection with even the mildest form of acute head cold. The Eustachian tube is the connecting link between the nose and the ear. This is a tube about an inch and a half in length, which runs from the post nasal space outward to the middle ear, constituting a sort of ventilating shaft, that keeps the tympanic or drum cavity supplied with air necessary to proper function and in a normal state of health. When the lining membrane of the canal becomes swollen by involvement from a cold, the result is rarefaction of the air of the tympanum, with a state of congestion, rendering it vulnerable to infection. In acute rhinitis, infection is very liable to travel through this tube, lined as it is with the same kind of mucous membrane as the nose, and if virulent organisms gain entrance, they may set up a suppurative process, constituting an abscess. The result is a perforation of the drum-head, with injury to the delicate structure of this region, and a greater or less degree of deafness.

We are fortunate if the process does not go farther and attack the mastoid, a serious matter in itself, and still more serious because of the possibility that from here the infection may travel still further and involve the contiguous part of the covering of the brain (meningitis), or the great veins in this region, or the brain itself.

See then what havoc may be wrought by the machinations of a simple cold! We have not overdrawn the picture, as any physician will testify who has followed his cases from beginning to end, and witnessed the direful results that have followed small and apparently negligible beginnings.

How important to prevent when prevention is possible, instead of waiting for grave lesions to occur whose removal is conjectural! Our first duty is to prevent a cold's occurring, but, this failing, our next is to prevent complications. This is usually possible by wise and skilful treatment, when dealing with a patient who is intelligent and willing to co-operate. It sometimes happens that the patient is in the greatest danger when least aware of it, and is more ill when the pain has subsided, a fact which the average individual has difficulty in realising, having formed the habit of regarding disease as altogether synonymous with physical pain.

IX

PRINCIPLES OF PREVENTION

A commander of an army in the midst of war, confronted or surrounded by the enemy will be constantly engaged in one of three orders of activities, which will be adopted according to conditions or circumstances at the time prevailing, these activities being namely, attack, defence and retreat.

When the forces of the enemy at any time seem to be inferior and at a disadvantage in position or preparation, he seizes the opportunity to make an attack; but when the situation is reversed, it is the part of wisdom to avoid conflict and sometimes the best tactics to retreat; while, if they seem equally matched, he may perhaps neither advance nor retire but aim simply to take the position of defence and stand his ground.

All agencies which tend to give rise in any way to disease are enemies of the body, intent upon its destruction, and must be resisted according to the same principles.

Colds as we have learned are the product of a multiplicity of causes, some direct prominent and near at hand; others indirect, subtle and remote. To the former class belong micro-organisms and certain special atmospheric conditions which are always in the front ranks in every attack. To the latter belong a great host of contributory causes which we designate as indirect causes, local and general, not always much in evidence, or obvious, but never-the-less of evil influence and just as important to be overcome.

Sometimes these hostile agencies of disease are of such threatening character, and so powerful that it would be foolhardy to throw ourselves among them, and thus fall a victim to their violence; at other times, however, our best policy is to bravely take the aggressive.

Let us consider some causes of colds that ought to be avoided. Disease germs are everywhere and always present, and cannot therefore be altogether escaped. We may, however, take care not to expose ourselves to them when they seem to be present in overwhelming quantity or in certain conditions which seem to particularly favour their unpleasant activities.

You may not be able always to avoid coming in contact with some one who has a bad cold, but you can at least avoid close contact as in kissing, or you can take care not to come within range of blasts of infected air discharged by acts of coughing or sneezing, wherein lie the greatest danger. You may also take precaution not to use a towel, handkerchief, or napkin that may have been used by persons who are infected; but one must, on the other hand, not go to extremes in his precaution, as we sometimes witness in those who are hipped on the subject, and develop such absurd phobias as to be afraid to shake hands, touch door knobs, or pieces of money for fear of infection.

An infant or very young child ought particularly to be kept away from an individual with an acute cold. On account of its tender age it has not developed good defence reaction or immunity against cold, and when a cold does occur there is danger that it may become very serious,—possibly developing into pneumonia. Elderly persons and those who have become enfeebled and run-down from any cause should likewise exercise especial precaution, and I would particularly emphasise the danger generally not sufficiently taken into account, of falling a prey to colds when one is mentally as well as physically depressed, or fatigued. If one finds himself at the end of the day in a state of anxiety or worry from the cares and responsibilities of his office, he should not go into a crowded, stuffy, badly ventilated place. It would be far better to take a little recreation in the outside air, making it a point from time to time to take deep inhalations. A game of golf, a horse-back ride, or a brisk walk will quicken the circulation and stimulate deep respiration, with invigorating effect.

Special mention should be made of the dangers of swimming pools. Here is where the germs flourish, multiply, and grow active. So far it has seemed impossible, notwithstanding all the various methods of purification and sterilisation, to render a pool used by a number of persons at one time perfectly hygienic. You may insist on thorough preliminary bathing and scrubbing, but there is no way to prevent germs getting into the water through which they seem to pass with extraordinary celerity from the unhealthy noses and throats to the healthy ones. In fact studies have been made, which prove that this will easily occur and every nose and throat specialist can testify from experience in his own practice to numerous cases of sinusitis and middle ear inflammation that have arisen from contaminated pools. It is because of so many disastrous experiences of this kind that special committees have been appointed by national medical societies to investigate the evils and inform the general public on the subject.*

Atmospheric influences giving rise to colds are, like the bacteriologic, always with us and cannot be altogether avoided. We have none of us our habitation in

> "Olympus, the reputed seat
> Eternal of the Gods, where never storms
> Disturb, rains drench, or snows invade, but calm
> The expanse, and cloudless shines with purest day."

In the mundane sphere upon which we live and move and have our being, we must expect, on the contrary, to meet with the various inclemencies of the weather. In this so-called temperate zone we have to adjust ourselves not only to the great variations of the seasons but, also, often to certain unexpected variations of temperature, moisture, and movement of the air that may occur within only a few hours.

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* The swimming pool menace has been especially emphasised by such eminent specialists as Fenton of Portland (Ore.), Hasty of Nashville, and Taylor of Jacksonville.

Aged persons, invalids, and those of naturally weak constitution or debilitated by disease may be justified in migrating to regions where the climate is mild and equable, and the rigours of winter are unknown, but for the individual of average health, with his life before him, this is a practice to be heartily condemned.

If we constantly evade the asperities of the weather we shall not be able ever to resist them, but if we expose ourselves in a reasonable way, we increase our powers of endurance, and make ourselves gradually less susceptible to their harmful effects. There is good reason indeed to accept the view of Huntington that no nation has ever risen to greatness except in a climate marked by storms, and sudden variations in temperature and humidity, not only from season to season, but also from day to day.

There are, however, limitations beyond which the individual may not be exposed without harmful results. Colds, we have found, occur because of great extremes, and great and sudden variations, and unnatural relations in the physical characteristics of the atmosphere. How far these influences may be borne with safety and when they must be avoided as dangerous to health, must often be determined by the co-existence of contributory causes. One may very well endure cold when in good physical condition and blessed with especially robust circulation and vigorous vascular reaction, but not so the anemic individual who leads habitually a sedentary life, and whose skin circulation is sluggish and inactive.

It must be remembered especially that to be exposed to cold while exercising, and while resting are two very different things. We see boys on the coldest days stripped to the waist and with bare legs, doing the Marathon practices with entire impunity, but how soon one would develop pneumonia in such a costume standing still or sitting! For the milder exercises one must be better protected in cold weather, especially in the case of a high wind which may cause a very rapid abstraction of body heat. The danger is particularly great in periods of rest and relaxation, with the body overheated, and perhaps in a state of perspiration. It is therefore advisable with the finish of a game of tennis, or other active sport on a cold or windy day, not to sit around without an overcoat or some kind of wrap.

There is much danger in remaining standing in cold halls or carrying on long conversations standing on street corners, because in these circumstances the abstraction of cold is not counteracted by the heat production of muscular exertions. It has been often remarked that long exposure to a slightly reduced temperature is much more likely to cause cold than the short exposure to a much lower one. In the former case there is no incentive to exertion, and chilling often occurs because of the absence of the reaction which naturally follows a decided cold stimulus.

The frequency with which colds are contracted upon attendance at a funeral is proverbial. Standing with head uncovered and feet perhaps on cold damp ground is enough to explain some cases; but I believe we should account as an additional factor the general depression of spirits which prevails on such occasions. As with regard to germs, we believe the atmospheric factors more easily take hold of those who are mentally, as well as physically, depressed.

Leonard Hill lays much stress as a cause of colds, on the inequality of the temperature of the air in the upper and lower strata of houses and theatres, public halls, etc., in that while the floors may be cold and drafty the upper layers of the air will be warm and stuffy; so that while the soles of our feet have become chilled, our heads are enmeshed in warm and stagnant air, this being just the reverse of the usual, natural outdoor relations. Furthermore does it not accord with the formula of health, bequeathed to posterity by the great physician Boerhaave, as the quintessence of the accumulated experience of his professional life, "Head cool, feet warm and bowels open?"

Under all circumstances one should avoid a draft. *Aria di fenestra, colpo di balestra,* says an old Italian proverb, meaning that the shot from a cross bow is not more deadly than the draft of air striking you from a half open window.

It is not a draft when the air, no matter how cold, comes from all directions and strikes the body from all sides, so that danger lies not in riding in an open carriage, but in a closed one with a blast of air striking the back of the neck through a partially open window; one need not fear half so much a room with all doors and windows open, as the insidious current through some small, hardly discoverable crevice. The menace of a draft is greatly enhanced if the surface of the body is at the time encased in warm layers of air and even more so if in a state of perspiration.

A badly ventilated living apartment is a condition, of course, to be avoided; and a prolonged stay in any habitation, private or public, in which many persons are congregated is prejudicial to the health, if the air be allowed to become stale and stagnant; likewise it is important, from the standpoint of colds, to be exposed as little as possible to a dust polluted atmosphere.

Diogenes of Apollonius, who lived about five centuries B.C., meditating upon some problems that have also agitated modern thought, offered an explanation of the superiority of man over the lower animals that seems to have escaped some of the controversialists of our own day. It was owing, he said, to man's upright position, by reason of which his nasal organs are farther removed from the earth so that he is not compelled to inhale so much of the contaminated air of the earth's surface.

There is a real danger, we feel certain, from the air blown into our faces from unclean streets, on a windy day, carrying diseased micro-organisms directly into the upper respiratory passages. Harmful effects are also sometimes produced by noxious fumes and gases connected with certain manufacturing processes and other causes; and from the smoke and dust of railroad travel, as also from chemical irritants and mineral dust connected with certain occupations.

Special mention should be made of gases used as a weapon of warfare. It is not generally realised that during the last war that of about 230,000 battle casualties treated in the hospitals for American troops, over 71,000 were on account of gas.

As consulting laryngologist at one of the larger hospital centres in the zone of advance, the author had exceptional opportunities to witness the devastating effects of the gas upon the upper air passages of our soldiers. It was especially during the forty-seven days of almost continuous fighting in the Meuse-Argonne drive, that train-load after train-load of gassed patients were brought to this centre.

At that time the gas almost exclusively used, was the so-called mustard gas, which acts as an intense irritant of the mucous membranes. In practically all these cases bacteriological invasion followed, so that our hospital wards were filled with patients who, in addition to severe burns sometimes producing extensive ulceration in the membrane, had developed severe attacks of rhinitis, pharyngitis, and laryngitis, of an infectious character.

In addition to the regular symptoms, it was observed that a great many of these cases suffered from more or less impairment of the senses of smell and taste, sometimes amounting to almost complete loss.

This we assume to be the result of the special effect of the gas, acting upon the nerve endings of the special senses, which might very well account for the insidiousness of its action, so often remarked.

Mustard gas has a tendency to settle in low damp localities, clinging to the ground for many hours after being deposited there. A history was frequently obtained of soldiers having slept in such places, unconscious of the danger that lurked all about them, to awake next morning to find themselves badly gassed. The gas having first taken prisoner the natural guardian of the air passages, the sense of smell, its continued injurious action was unsuspected.

Severe as these cases were, the use of gas of this type, contrary to general opinion, was evidently not the most inhuman form of warfare. The fatality was only 2%, as compared to 5% from rifle balls, 6% from shrapnel and 20-26% from sabre wounds and airplane bombs. In from two to four weeks most of the gas cases were ready to be sent back to the front, and it was really very seldom that there were any serious after effects.

X

METHODS OF PREVENTION

While certain of the contributory causes of colds are unavoidable, there are a great many which could and should be prevented. As we have elsewhere pointed out, cold catching is closely connected with what we call the comforts of civilisation, and is largely due to our unhygienic habits of living. It is not enough that we recognise these causes. We must know how to circumvent their evil influence, by the substituting of the practice of proper methods of life until they become fixed habits.

First and foremost of the evils to be condemned, and probably the most prolific single cause of colds in this country, is the overheating of our living and working apartments. The harmfulness of breathing very warm air lies in the circumstance that air, as it becomes warm, becomes also relatively dry. The super-heated air in its avidity for moisture tends to abstract the natural moisture secreted by mucous membranes of the nasal passages, so that these passages become unduly dry and parched, and cannot perform their normal functions.

One of the important purposes of the serum secreted by the nasal mucous membrane, is undoubtedly to protect against infections; we observe how the secretion is increased and, at the same time, sneezing provoked in the event of any irritation of the membranes, and it is known to have an effect that is directly inhibitory to the growth of micro-organisms. The parching of the parts in the dry over-heated air in which many persons remain for hours must have the effect of inviting the germs to do their worst.

The ideal atmosphere is considered to be that of 68 degrees F. with a relative humidity of about 40 or 50 per cent. And this is, if we would but realise it, the most comfortable as well as the most healthful. We have allowed our temperature sensations to become vitiated by habit and there is a desire for more and more heat, like the vitiated taste for more sweets, for more tobacco or more alcohol. At a temperature of 68, it is not difficult to maintain a humidity of 35 or 40, but let the temperature rise to about 75, which is not uncommon in our American homes, and you will discover if you will make use of a reliable hygrometer, that your relative humidity has dropped to the very unhealthful ratio of about 20%.

Unfortunately there does not exist any artificial means of maintaining it at the desired level. For households of moderate size, it is estimated that many gallons of water would be required, and this is found to be impracticable. One of the unfortunate features of the situation is that with the air very dry one may feel a chilly sensation even with great heat, because of the increased loss of heat with moisture from the body by evaporation, so that the result is that persons living in a hot air continuously demand greater and greater heat.

Next to improper methods of heating houses, we believe the most important indirect cause of colds, consists in improper methods of dress. We have alluded to this in Chapter VI, but the subject is so important that we go into it again with further detail, at risk of some repetition.

For civilised people clothes are necessary for reasons for modesty and protection and to economise the heat of the body. It is estimated that people in moderate circumstances, not affluent, spend about 15% of their income for clothes, compared to 20% for rent and 25% for fuel, a sum more than necessary for the mere purposes stated, and indicating that decoration is an important secondary motive. Dress may be harmful, from the standpoint of health, in being too heavy or too light, covering too much surface or too little, too constrictive, or of a material which interferes with the normal functions of the skin. Harm is also done in wearing clothes which are unsuitable to one's mode of life or to the season or the climate in which one lives.

It is necessary to have enough clothes to protect from chilling of the body, and especially so with old people, children, and invalids. Children must be always well clad in cold weather, because they have in proportion to their weight a greater surface of skin from which heat may be lost by conduction, convection, and evaporation; and old people and invalids, because their powers of heat production are diminished.

A greater fault than underdressing, however, is that of overdressing. It is said that Venus springing from the foam of the sea and wafted by gentle breezes over the surface of the waves, landed at The Isle of Cyprus, where she was received and properly attired by the Seasons. There is no authority for the belief that they then and there clothed the beautiful goddess of love in furs. It is too evident that Venuses of to-day are not guided in their choice of apparel by the same advice, for certainly the wise and experienced Seasons would be shocked to see them on the coldest days in winter, arms and chest completely naked and legs almost so, and in the summer draped in northern furs.

Furs and heavy wraps, when necessary to be worn out of doors because of the extreme coldness of the climate, should be immediately discarded on entering a warm interior. To sit through a lecture, or the church service, or spend the morning shopping or the afternoon at tea, when the temperature of these indoors places is probably about 75 degrees F., with the same heavy fur coats and wraps that one wore outside, is to send a cordial invitation to the Demon "Cold" to come and do its worst.

Special protective dress for particular parts of the body is seldom necessary for man or woman, as it is usually impractical to wear such only when needed, and to discard it when not.

Ear muffs and boas, scarfs, chest protectors, leather vests and leather jackets, are for the most part hygienic misfits; one becomes accustomed to them, and unable to dispense with them, and nevertheless is always in danger of being caught without them when most needed.

Aeration of the skin is essential to healthy skin function. The wearing of dense impermeable dress is something as much as possible to be avoided, because it keeps out the air and because the evaporation of the sweat secretion is hindered by impermeable stuff. It is probably on account of the necessity of wearing leather shoes, that colds are more often contracted by way of the feet than any other way. Frequent change of shoes and stockings, not only day to day, but once if possible in the course of the day is a useful precept to follow and necessary for those subject to damp perspiring feet. If because of rain, snow, sleet and slush one must sometimes wear rubbers, arctics or mackintoshes, at least the precaution should be taken to discard them when indoors or to wear them as little as possible.

The question of underclothes is one of much interest in relation to the susceptibility to colds. A maxim of first importance to be emphasised above all others, is that the underwear for the average individual in this climate should be of the same weight the year round. This is simply because most of us spend the greater part of our time indoors and in a temperature which is as warm if not warmer than the usual outdoor weather of summer. If we adopt a heavy flannel for the winter season, then during all the time that we remain in our warm (and generally too warm) homes and offices, we will suffer from overheating of the body, our skin surface will be constantly bathed in unhealthy perspiration, and we become more and more tender, and more and more susceptible to colds. If, on the contrary, we adopt a light underwear the year round, we are comfortable indoors and on going out on a cold winter day we can protect ourselves from cold by suitable wraps and overcoats. The Russians, despite their severely cold climate, are said to catch colds with relatively little frequency, and in no small part is this probably to be attributed to the habit of wearing a simple coarse linen underwear, putting on heavy coats for the icy blasts of their outdoor winter life.

As to whether we should wear next to our skin, garments of wool or of linen, is a matter to be determined not only by climate, but by one's mode of life and one's age and state of health. Woolen material is a poorer conductor of heat than linen, and therefore somewhat warmer. It is best for those who must spend much of the time exposed to very cold weather, and probably for the aged and enfeebled.

A matter of much importance in underwear is its property with regard to the absorption of moisture, because the skin is constantly eliminating heat by evaporation. Wool is slow in absorbing moisture and slow in giving it up. A woolen garment will therefore remain a relatively long time saturated, and when this is the case, chilling can take place from rapid loss of heat. Linen, ordinarily does not conserve the heat of the body as well as woolen material, because its fibres do not contain as much air which is a poor conductor. It can be so woven as to improve its character in this particular, and it has an advantage over wool in that the moisture is more readily absorbed and so interferes less with normal cutaneous functions. In our climate it seems therefore for the average person the preferable material for undergarments, and apparently for the same reason as that given in Ezekiel to the chosen people, "They shall be clothed with linen garments and no wool shall come upon them: they shall not gird themselves with anything that causeth sweat."

Any one who seriously strives to avoid all the causes of colds, must be careful not only as to the air he breathes, and the clothes he wears, but also as to the food he eats. That colds are often toxic in origin is one of the important teachings of our generation, well emphasised by Stucky, Dwyer, Shurley, and others of our leading rhinologists.

If the intestinal canal were uncoiled and extended, its length would be seen to be 5 or 6 times the length of his body. From this extensive surface, there is therefore a large possibility for absorption of toxins, if the food be indigestible, and intestinal action sluggish. Overloading the stomach is a hygienic fault at all times to be avoided, but, from the standpoint of colds, care should be particularly taken to guard against excessive ingestion of the nitrogenous foods. It is from the red meats in particular, when taken in large quantities, that end-products are formed, which give rise to excessive acidity of the blood and various toxic conditions.

One does well then, on general principles, to restrict his proteins, and increase the use of fresh vegetables, fruits and fruit juices, to exclude cheese, meats and beans, rich highly seasoned food, pastries, fried articles and hot, freshly baked breads. Tea and coffee taken in excess, are probably to be ranked as, in some cases, factors, and to be avoided by those especially prone to colds.

It is common belief that alcohol is of value in protecting against cold, and helps to prevent catching cold. The physiological effect of alcohol is to bring about, shortly after being ingested, a dilatation of all the little arterial blood vessels throughout the skin, and cause a determination of a great part of the blood from the interior of the body to its surface. This is often very noticeable in the flushing of the face. The effect of this is to produce a glow and general feeling of warmth, even in spite of a surrounding cold temperature, but remember, that at the same time there is an actual loss of body heat which naturally takes place from the warm blood circulating in the surface.

Nature does exactly the opposite thing on exposure to cold; it causes the blood vessels to contract in the cutaneous surface and the blood to be driven inward, because it is the aim of nature to conserve the body heat. Alcohol therefore in case of exposure to cold, while giving a sense of warmth and well being, is really antagonising the natural mechanism of defence, and is causing actually a greater loss of body heat and lessening the powers of resistance. Now, after one has been exposed to severe cold and then comes into a warmer environment, the tone of the cutaneous vessels naturally relaxes, and the contraction is superseded by a dilatation such as that produced by alcohol. At this time "just a little drink will do no harm," and may be useful to those whose natural reactions are sluggish.

There are many people who do not react well from a cold exposure. We sometimes see at bathing places, persons who after coming in from the water are shivering and cold, with blue lips and goose skin, instead of having a normal glow. For such persons a dose of brandy or other alcoholic beverage is definitely indicated to promote reaction and prevent loss of heat.

"Before the dip, never a sip,
After the dip, you need a nip."

happens to be then a seaside doggerel, not without physiological basis.

The excessive use of alcohol, is to be scrupulously avoided by persons susceptible to colds, not only on general grounds, but because this agent has a special deleterious local effect. The mucous membrane of the nose and throat of regular drinkers will nearly always develop a state of chronic congestion and irritation, which will show exacerbations with every new indulgence.

Closely associated in our minds with the habit of using alcohol is the tobacco habit. There are not lacking authentic observations of the effect of tobacco, proving the deleterious effect of its excessive use upon the digestion and upon certain parts of the nervous system, and, it appears, that even its moderate use, if long continued, has a decidedly unfavourable effect, hindering the normal growth of the body and the development of the intellectual faculties in young persons. In the habit of smoking, the fumes are brought constantly in contact with delicate membranes of the nose and throat passages. Whether the effect is to be attributed to nicotine or to ammoniacal vapours or other substances,—the products of incomplete combustion, may not be determined, but it is certain that it acts as a local irritant. Congestion of these parts therefore is bound to result from its continued or excessive use, and since congestion renders the parts susceptible to infection, it is obviously a bad influence.

We have often observed that the effect of smoking is not always confined to the smoker. Any person who spends an evening in the company of smokers, especially in close, stuffy, ill-ventilated rooms, will often show the next day a congestion of the throat, just as marked, we believe, and in many cases more so, than that of the ones who did the smoking.

In the warfare against colds, it is necessary also that certain internal causes be sought for and removed. In the last analysis all causes are of external origin, but it is more convenient to list as internal causes of colds certain general and local body conditions, whose relationship is evident and near at hand, rather than their ultimate remote causes. The chief general internal conditions are diseases of the heart, liver, gastro-internal tract, kidney, and skin.

Serious organic heart troubles cannot be removed, but it is imperative that they be recognised if present, as much can be done in the way of proper methods of living and medical treatment to keep them under control. This is very important to prevent passive congestion in the mucous membranes of the nose and throat as well as of other organs.

The liver in a large measure performs for the body the functions of a filtration plant, serving to remove or make harmless impurities which have gained entrance to the system and are circulating in the blood. As a result of certain external causes, as various infections, or a too stimulating diet, or alcohol in excess, these functions will come to be imperfectly performed with deleterious consequences to all parts of the body. The diagnosis and treatment of such conditions is a matter requiring the advice of a competent physician.

Of prime importance in connection with the occurrence of colds, is the state of the so-called eliminative organs of the body, the gastro-intestinal tract, kidneys and skin, for, when they become disordered, toxic products accumulate which by their irritating effects upon the respiratory membranes give rise to the so-called "toxic colds."

The chief underlying cause of cold catching is certainly for many persons to be traced to a disturbed state of their digestive processes. It is fatuous to expect any permanent benefit from the use of sprays, douches, inhalations or any other local treatment, when the real trouble is a state of general systemic auto-toxication, the result of sluggish gastro-intestinal functions. These are common faults in individuals who lead a sedentary life, get very little exercise, and over-eat.

The kidneys are organs also, which are concerned in the removal of waste products of nutritional change, especially those formed by the ingestion of nitrogenous substances. They must not be over-taxed, and they must be kept active by drinking freely of water.

From what has been already said about the skin, and its close relationship with the nasal organ, in connection with heat regulation, we should readily realise how easily the nasal mucous membrane can be affected in case of derangement of the cutaneous functions. When one goes from a warm place to a cold one, the blood vessels normally contract to conserve heat; when from cold places to warm ones they should dilate to allow needed escape of heat. But, if the skin is in a bad condition, its vessels relaxed and sluggish, these necessary skin reactions will be lacking; the vessels will fail to respond in a normal way to temperature changes, with immediate ill effect upon the respiratory organs.

The skin moreover is an important eliminative organ, having a close relationship with the kidneys in the performance of this function. There are some two million sweat glands distributed over the surface of the skin from which there is the escape of an average of three pints of water daily, and, in addition, a number of sebaceous glands which excrete oily substance. These glands are extremely minute, and may easily become clogged and ineffective from the accumulation of oily material mixed with the dust and scaly material cast off from the outer layer of the skin. The old fashioned idea, that there is danger of catching cold when one goes outside with the "pores all open" ought evidently to be exactly reversed, as the real danger is with the pores all closed. Cleanliness of the skin then, as well as a good healthy tone of its circulatory vessels, are both to be taken into account in all schemes to prevent cold. The latter is probably the most important of all factors, of which we shall have something to say when discussing the subject of hardening.

Finally, of causes to be removed we must mention the local ones. Any kind of trouble in the nose that interferes with breathing or that produces pressure or irritation, is harmful to the mucous membrane and acts as a predisposing cause of head colds. Nasal obstruction is, in many instances, due to malformation in the interior of the nose, which in turn is, in most cases, the result of injury to the nose during early life when the parts were tender and flexible. Obstruction, however, is frequently due to the presence of a simple inflammatory growth, known as nasal polyps. These are non-malignant, but they nevertheless may grow to great size, are frequently of multiple occurrence, and show a tendency to recur after removal. They are of soft gelatinous-like substance, grow in pendulous masses from the sides of the nasal cavity, and are called polyps from their fancied resemblance to the sea mollusc or polypus. It is important that they be removed as soon as recognised, and if one wants to guarantee against their recurrence it is quite necessary that the ethmoid cells be radically operated upon, because there is in all cases underlying disease of these sinuses.

We have already spoken of adenoids and of the rôle they play in the causation of colds. In young children they are by far the commonest cause of head colds, in fact, some children with adenoids seem to be almost never without colds. They usually cause nasal obstruction, but not necessarily, because these growths, especially in a capacious throat, may be located in a way not to obstruct the posterior openings of the nasal passages. They predispose to colds because they are structures very vulnerable to the attacks of micro-organisms, and the infection quickly spreads throughout all the nasal membranes. These growths therefore should be suspected in every child that has frequent colds, and, if discovered, should be removed without delay.

As, in nearly all instances, the tonsils, which are of a similar nature, are likewise involved, they too should be removed at the same time.

We have been hearing in recent years a great deal of sinuses and sinus colds. As these are cavities hollowed out of bone and situated adjacent to the nasal passages and communicating with them, and since they are lined with mucous membrane continuous with that of the nose, it is only natural that they would become involved by extension of any inflammation there.

The fact is, sinus disease is not only caused by inflammation in the nose proper but in turn will cause it. It often happens that the sinuses become filled with pus or muco-pus, and by reason of closure or unfavourable situation of the channel of communication, the pus remains pent up in the cavity, so that you have what amounts to a closed abscess. That is, of course, a constant menace, acts as a focus of infection, and predisposes the patient to colds of the severest type.

The chief evidence of sinus affection is the presence at one time or another of abundant, thick, yellow discharge from the nose, and the presence of pain in cheek, or forehead, or one-sided headaches, although in many cases pain is completely lacking. In every case of severe cold which is persistent or shows tendency to recur, the sinuses ought to be carefully examined. Brilliant results will follow properly directed treatment. In cases of only short standing, mild intervention will generally prove successful; in chronic cases, or those in which the bone has become diseased, radical surgical measures may be necessary.

XI

THE PRINCIPLES AND PRACTICE OF HARDENING

"Life," remarks Seneca, "is a state of warfare," and as a successful war cannot be waged by assuming always a defensive attitude, but requires at the proper times an active aggressive policy, so, in fighting the enemies of the body, there must be eventual failure if one adopts without change a course of inertia, inactivity, and evasion.

Yet we do see many people who believe implicitly that by shutting themselves indoors and never venturing forth, they are safe against the dangers of catching cold. As a matter of fact we know that this is the surest way to fall a victim, if not at the very time, then very easily later on. Colds are mainly for those who in this way have grown to be soft and susceptible. As the exercise of functions is essential to the development of vigour, the coddling habit can have no other effect than to lessen the powers of resistance; and a pampering process is the surest means to paralyse the natural forces of immunity.

A muscle seldom exercised grows soft and flabby, nerve cells become inert which are seldom stimulated; arteries relax when not frequently called into action; glands fail to secrete and atrophy if function is long suspended; and a joint that is never moved, in time becomes stiff and useless.

It has happened quite often to me to hear a patient complain bitterly of a severe cold, protesting that he has done nothing to contract it. "Doctor, I cannot understand for the life of me how I caught this cold. I have been more than usually careful, and have not done a thing so far as I know to make me catch it."

The answer is, it is not enough that one should do nothing to catch cold, it is necessary that one do many things to avoid such a result. One must, in fact, make special efforts and put into practice special procedures which have for their purpose the habituation of the body to the conditions which are recognised as the causes of colds, and thus make it capable of withstanding them. One seeks, in other words, to fortify the natural resistance of the organism and to augment the forces destined to overcome disease, by a process which is known as hardening.

In the case of colds, hardening methods are especially in order with reference to various atmospheric conditions, because these are ever present factors which cannot be escaped, and because means are available to reproduce at will the same or similar conditions, in measured dosage.

Hardening is concerned essentially with that mechanism of the body, which has to do with heat-regulation. Man is a homoiothermic animal, that is, his internal temperature must be kept uniform. To maintain at all times an equable internal temperature, he is provided with a special heat-regulating mechanism. This achieves its effect by the contraction and relaxation of the diminutive arteries which supply the skin, under the control of sensitive heat-regulating nerve centres in the spinal cord.

As elimination of heat depends upon the state of the cutaneous circulation and the accompanying activity of the sweat glands, it is clearly important that these functions should be always accurately responsive to atmospheric variations. This adaptability of the cutaneous vessels, as it may languish with disuse, so it may be cultivated by practice. Therein lies the value of hardening methods, which aim to exercise the vaso-motor mechanism of heat regulation. There have been some absurd doctrines taught and put into practice in the name of hardening, which we are convinced have done more harm than good. It will be well, therefore, to consider the true underlying principles, upon which correct hardening methods are based.

The first and fundamental principle that should be made to apply with regard to all hardening methods for colds is this: accustom the body only to those weather conditions to which in the ordinary course of existence the individual may expect to be exposed. Owing to the vicissitudes of our climate, we must encounter various atmospheric states with reference to cold and warmth, moisture and dryness, and movement of the air, to all of which it is desirable we should become accustomed.

One may take occasion to face all kinds of weather inclemencies in a reasonable way, but no good purpose is served, and much harm may be done by foolhardy exposure. To tramp around in the snow with bare feet, to go about on a cold windy day without hat or overcoat is a senseless fad, for which there is no valid excuse.

Hardening, by whatever methods may be chosen, must begin lightly, increase gradually, and never be excessive. It should be begun in a manner to make slight demand upon the vital energies. This is especially true in young children, whose reflex mechanisms are undeveloped and untrained. There is no greater hygienic error than to start a young child off suddenly with a routine method of hardening without due regard to the fitness of things. It is a practice fraught with much danger to the child's delicate organism.

The hardening process should have a gradual increase with such additions at each successive step as can be certainly and safely borne. The law of gradual increase of load, is one of nature's laws of which there are many illustrations. The muscles grow by exercise, and learn each day to lift a slightly heavier load, but the increase must be gradual and without excess. Great care should be taken that the limit of tolerance be not exceeded. The muscle loaded beyond capacity of endurance is strained. First comes fatigue, the danger signal; if this be not heeded, soon comes strain, then exhaustion, and finally degeneration with irreparable injury. "Everything in excess," said Hippocrates, "is averse to nature." In fact excess ends usually by defeating its own purpose. A muscle by exercise is strengthened, but over-exercise will cause serious strain and injury; a nerve cell grows efficient by normal function, but may be paralysed by over-stimulation.

The object of hardening is to prevent colds by exposure in a measured degree to the causes of colds; but if the exposure is excessive the result will be to cause colds instead of to prevent them. Therefore, whatever may be the means adopted with a view to hardening, see to it that it is not carried to a dangerous extreme, causing the very thing it has been our object to prevent.

Whenever exposure to cold is used as a stimulus for the purpose of hardening, it is essential that a healthy reaction be obtained.

An important requisite in the employment of hardening methods is a normal consciousness of temperature variations. Beside the nerves of common sensation there are distributed throughout the cutaneous covering, myriads of minute nerve endings, for the special sense of heat and cold. To have a reaction it is only necessary that the stimulus be a degree or so below the point of indifference.

Exposure to cold within physiological limits induces a normal reaction recognised by a healthy glow and general feeling of exhilaration, but if the stimulus be excessive and the reaction fail, the individual may experience an unpleasant shock, evidenced by chilliness or even a state of collapse. Individual differences must always be taken into account, as all persons are not constituted alike in their powers of reaction, and some have decided idiosyncracies in this particular. As the reaction is the real measure of the value of a cold stimulus, the latter should be graded with reference to this result. The sensation of the patient must not be ignored; children especially have often a great dread of cold in the form of the cold bath or cold shower, and harm has often been done to their nervous systems in forcing these measures on them.

Hardening methods designed to prevent colds should never be employed at the time that one has a cold. When one has already acquired a disease, all of the energies of the system should be occupied with efforts to get rid of it. It is not the proper time therefore to make extra demands, or tax the energies with additional burdens.

Beneficial as we know exercise to be, it is contrary to nature and positively harmful to persist in the exercise of a muscle that is already fatigued. Similarly, hardening methods, however valuable during the period of good health, or the interval between colds, are never to be adopted when the individual is struggling to get rid of an attack. A disordered mechanism cannot respond in a perfectly normal way. There is, in the case of individuals in the grip of a cold, an evidently disturbed balance in the heat regulating mechanism and an abnormal sensitiveness to thermic impressions.

When the patient therefore is suffering from the acute state of a cold, he should not be exposed to cold temperature, but remain indoors in a warm comfortable room. Instead of engaging in strenuous physical exertions, it is best for him to rest quietly in bed. It is entirely wrong then to employ cold baths, cold plunges or cold showers, which are so valuable as hardening methods at other times, but he should take only hot or warm baths.

The three methods employed for hardening against colds are by exercise, air, and water.

The beneficial influence of exercise upon the body economy has been long recognised by the general public as well as by the physician. People for the most part having a personal realisation of its freshening, invigorating effect, come to enjoy exercise and are inclined to continue its use; unfortunately it too often happens that because of the demands of business, society or other reasons, it is omitted. This omission should be always fought against, because with abstention a natural indolence too easily develops and a sedentary habit replaces the habit of exercise.

Muscular activity is essential for healthy living, and its benefit is not confined to the muscles themselves, but has its reflex throughout every organ and part of the body. The physiological explanation of its value is found in the increased flow of lymph and blood, and the increased chemical and physical change affecting all the tissue cells. Heart action is strengthened, respiration quickened, and the digestive functions improved. When muscular exercise is practised every day, one does not need to prescribe breathing exercises, because this must follow as a natural physiological need.

From the standpoint of colds the great value of exercise lies in the effect it has upon the cutaneous circulation. With increased muscular activity there is of course increased heat production, and the system aiming to maintain a normal balance rids itself of excess by bringing about dilatation of the small arterioles of the skin, and increased activity of the sweat glands. Thus is relieved the internal congestion which favours inflammation, and thus is acquired that discipline of the heat-regulating mechanism, which is the great object of all hardening methods.

The best exercises are those which engage the greatest number of muscles. The object is not to develop excessive strength in one or in a group of muscles, but to promote a healthy function of the body by general muscular activity. It is well then to vary the exercises in as many ways as possible. The most beneficial are those of various games and sports, for the reason especially that they are without conscious effort, and are attended with an agreeable exhilaration of the spirits.

Of course, we must accustom ourselves to air, and become hardened by exposure to various atmospheric variations, because air is our natural environment. We hear a great deal about the hygienic importance of having fresh air for our lungs, but very little attention is given to the equal necessity of having cold air for the skin.

As pointed out, atmospheric air is fairly constant in the proportion of its chemical constituents but very inconstant in its physical properties. It is the latter which are of importance to us from the standpoint of cold catching, and consequently in the consideration of the subject of hardening.

Inasmuch as in the ordinary transactions of life we cannot escape the vicissitudes of climate, it is incumbent upon us to harden ourselves to all of the physical variations of the atmosphere. Nothing is more absurd than the notion that the most healthful locality is one in which there is an even or equable climate, or that one should in one's own homes keep the temperature at a constant mark. One needs at times the stimulating effect of a change and above all the wholesome invigorating influence of cold.

If we have been shut up for hours in close, over-heated, ill-ventilated apartments, and we feel the need of fresh air, do not aim to let it in gradually, but throw open all the windows widely for a few minutes and let the cold in suddenly. This we have already recommended in the chapter on Causes. There is really no danger even on cold winter days, in catching cold in this way, and the the effect is magical.

Cold air has a good effect upon the breathing apparatus, in that it stimulates the lymph glands and causes a beneficial secretion of lymph, but its greatest value lies in its wholesome influence on the body surface. It is of great importance that the naked skin should become accustomed to feel fresh air. Benjamin Franklin saw this and advised as a useful rule of health that the body, divested of clothing, should be exposed a few minutes at least every day to the air. It is an excellent practice and the best means to counteract the over-sensitiveness of the skin, due to its being usually enveloped in impermeable clothes.

"The Polar bear slept in his Polar bear skin,
And slept very well, I'm told,
I tried to sleep in my bare skin,
And caught a H— of a cold."

Which shows not only the need of hardening, but also that hardening methods in the case of cold air, as with cold water, should begin lightly, increase gradually, and never be excessive.

There are many people who flatter themselves that they do all that is necessary for health's sake when, bundled from head to foot, they go for a ride through the city park. This they call taking an airing, but the only part of the body surface which gets the benefit is the face, which needs it least.

You know the story of the healthy savage, and his reply to the astonished traveller who could not comprehend how he could stand exposure to the cold weather almost naked. He said, "You have no clothes on your face. Have you?" "No." "Well, me all face." It is indeed astonishing how one can by practice, accustom the body even to quite cold air; beginning as we have said gradually and doing it a little more each day, with care not to go to excess.

When exercising at the time, it is perfectly safe to go out almost naked for a short time on the coldest day. As elsewhere noted, we are all familiar with the sight of young men doing the Marathon training exercises, trotting through the streets stripped to the waist and with bare legs. Sailors wear habitually low collars, exposing their necks to all kinds of weather, with impunity, and there are no statistics that I know of that indicate they are more subject to sore throat than other people.

There is no part of the body, which is so completely protected and so persistently deprived of air as are the feet, and it is the universal experience that there is no part of the body which is more sensitive, and which is more often responsible for colds. Youngsters roughing it in the country and going about a great part of the time barefooted have on this account a great advantage over us grown-ups, but opportunity should be taken by every one to aerate the feet when possible. We repeat here the advice given in another connection, to change shoes and stockings whenever the feet are wet or damp, and if possible at any rate once in the course of the day.

Of all methods of hardening, the most valuable is the use of water, because it is susceptible to exact dosage, both as to temperature and duration of exposure. Bathing, first of all, has a certain hygienic usefulness from the standpoint of the skin. As a result of the secretion from the sweat and oil secreting glands, the surface becomes covered with a layer of oily matter, which left unwashed undergoes in time decomposition and gives rise to an objectionable odour. Furthermore it clogs the openings of the minute sweat glands and interferes with their functions, which are, as already emphasised, of much importance in the heat regulating processes of the body.

The warm bath therefore is at times necessary, but it may be overdone, for used with too great frequency especially with soap, the skin may become dry and harsh. After a hot bath, the vessels of the skin are dilated and relaxed, and it is a good general rule that all hot baths should be followed by a short application of cold water in some form, as a shower or plunge.

Cold baths, both in the matter of temperature of the water and the length of time, must be different for different individuals according to their age and strength and previous habits, taking particular note of the character of the reaction which follows. There are some persons who have real idiosyncracies with regard to the cold bath, but there are certainly few, who cannot with a little gradual, careful training accustom themselves to a right cold bath and even in time come to enjoy it.

In experiments made in the case of dogs, it was found that if the animals were immersed in cold water for ten minutes for a number of days in succession they acquired quickly a power to withstand the cold. In the first and second days six degrees of temperature were lost at the end of the immersion, on the third and fourth days two and a half degrees, while in the end of a week there was a lowering of only a half degree of the dog's temperature.

In the case of man, it is not known whether or not there would be such a quick education of the heat regulating mechanism; at any rate, it is not necessary to undergo such a strenuous trial. One may begin with a temperature but little lower than that of body, and each day following, reduce the temperature of the bath only one degree. A genuine cold bath should be very short in duration, from ten to thirty seconds for most people, or at most not longer than sixty seconds. This will be sufficient to bring about a reaction lasting several minutes, and this reaction may be assured or increased by brisk friction with a coarse towel.

Cold baths should always be taken in a warm room, the best time being in the early morning following the regular morning exercises. It should not be taken within an hour after a full meal. Cold bathing should be completely suspended when one has been stricken with an acute cold.

The greatest precaution is necessary in the case of young children. Their reflexes are undeveloped and so one cannot always count upon the occurrence of a normal reaction. The water should be only a little below body temperature; or one may use with good effect a rub with a cold towel. Thoughtless use of routine cold baths in children has been known to have serious consequences to their nervous systems.

Even in grown persons the cold bath is without benefit if it be not followed by a good reaction, evident in the flushing of the skin and the general feeling of warmth and well being which immediately follows. Used in this way, the regular cold bath, tempered to the individual capacity, has a marvellous influence in overcoming sluggishness of the skin vessels, and training them to good vigorous response to the cold stimulus,—the best guarantee against the hazards of cold catching. The beneficial effect is felt throughout the whole system and there is general improvement in the nutrition of all the body cells; benefit is noted especially in the improved function of the respiratory and digestive organs.

Particular attention should be given to the feet, because they are encased so much of the time in impervious and often tight fitting leather, so that the circulation is impeded, and the vessels have become lax and sluggish. It is therefore a very natural craving that children have on the first warm day of spring to take off their shoes and go wading in the cool running water. In this light the wisdom of the advice given to the ancient hero Theseus is readily understandable:

> "This be thy guide, O man of woman born,
> Bathe well thy body at the break of dawn,
> But if ye would ablution make complete,
> Neglect ye not that pair of precious feet."

Sea bathing is doubly beneficial, because of the stimulating effect of the cold salt water, and the muscular exercise from battling with the waves. A common mistake made by bathers is to remain in the water too long. Fifteen to twenty minutes is for the average person sufficient, and those not accustomed should remain not longer than five minutes.

All good is cancelled and probably harm done, when one comes from the water with teeth chattering, skin goose-fleshed, and the lips purplish. One should immediately use the towel and put on clothes after the bath, as otherwise a good reaction would be lacking. There is much benefit to be derived from the salt air, and the rays of the sun, but they had better be before the dip, instead of afterwards. Also one should take care not to bathe too soon, that is, less than one hour after a regular meal. The best time is just before the meal hour.

XII

HOME CARE AND TREATMENT

The main object of home treatment of colds should be their prevention, and we are confident that were it possible to assure intelligent application, appropriate to each individual case, of the principles and practice set forth in the preceding pages their frequency would be materially reduced.

We must reckon, however, with the natural infirmities of the will as well as of the flesh. People may become well informed as to what is best for the health; they may have good intentions to do what is best—even make a good beginning, but resolutions fail and the ills they might so well have avoided, soon follow.

The cure of colds is, fortunately, not quite so hopeless a matter as might be inferred from some of the pessimistic comments emanating from the profession. Medical treatment is of value, not only for mitigating the discomforts of the affection; for, if intelligently administered, it will often succeed in abbreviating its duration. In the first place it may do much in preventing the attack from becoming converted into a chronic catarrhal condition, and in forestalling the occurrence of complications. Expert advice is imperative in the event of certain complications, for as elsewhere pointed out a serious outcome is always a possibility.

In most cases, however, special medical treatment is unnecessary; besides, there are a great many people who could not afford it and must get over their colds as best they can without it. It is therefore in order to outline such measures of treatment as the patient may himself apply, with special reference to those things which are safe, simple, and conveniently available.

Before discussing what should be done it may be well to say a word as to what should not be done, for the old aphorism of Hippocrates the father of medicine, *primum non nocere*, has its useful application in this connection. There is never any lack of suggestions on the part of neighbours, as to how to treat your cold; and the newspapers carry luring advertisements of "colds cured in a day," which one who "runs may read."

The most important thing to know to protect us against some of these follies is that a head cold is not a simple unchanging malady which must yield always to single remedy, but one that requires the judicious selection of remedies appropriate to the case, and especially to the particular stage of the disease, combined always with a rational hygiene.

Referring to the description of the course of a common cold under the head of "Symptoms, Complications and Sequelae," it will be recalled that a typical case is characterised by three stages, first the dry stage, second the stage of watery secretion, and third the stage of mucous secretion. During the first stage, which lasts usually only about twenty-four hours, the mucous membranes are swollen, dry and excessively sensitive. The second stage, which lasts usually from one to three days, is marked by the occurrence of abundant watery acrid secretion. The third stage is characterised by the fact that the discharge now assumes a mucous or muco-purulent character. At the onset of this stage the acute constitutional symptoms, which have been present until now, usually subside.

Treatment that is proper to one stage of the affection may be entirely inappropriate to another. In the first and second stages constitutional symptoms are prominent and internal treatment is indicated, but on account of the highly sensitive state of the mucous membranes, local treatment is generally to be avoided, especially the use of stimulating or astringent remedies, which only increase the congestion and produce irritation.

Quinine is a component of nearly all of the mixtures designated for internal administration for the cure of a cold. It is without doubt one of the most useful drugs in the whole pharmacopeia, in its proper place, but I have yet to see a single case of cold that was ever cured by it. In excessive dosage as sometimes used, it produces congestion of the labyrinth of the ear, and it may be responsible for permanent deafness.

Alcohol, usually in the form of rum, brandy or whiskey, is a popular side partner with quinine in the choice of a cold cure. It is with no intention of increasing the popularity of alcohol that we have ventured to disparage its disagreeable associate. We have pointed out some of the dangers of alcohol in discussing the problem of catching cold. As its physiological effect is to bring about a determination of the vessels to the surface of the body, with increased loss of body heat, it should never be used on going out into the cold, but in coming from the cold outside to indoors, it may be helpful in promoting a necessary reaction.

Because of the physiological effects mentioned too, it is a useful adjunct in hot drinks used in the first stage of a cold for the purpose of bringing on a perspiration. It has no value in the late stages of a cold, and can do great harm in any stage when taken in excess.

When it is certain that one has just contracted a cold, evidenced locally by a stuffy nose and a tendency to sneeze and generally by a sense of chilliness soon followed by a feverishness, headache and general malaise, the wise thing is to remain indoors, in a comfortable warm room. Rest in bed for a day or so is strongly advised; also care to keep the body warm and to avoid drafts. One should refrain from cold baths, cold showers and strenuous exercises, for it must be clearly understood that all those hardening methods, so valuable in the intervals of cold, as measures of prevention, are directly contra-indicated when the cold has been contracted.

The diet should be light and free from nitrogenous foods. Nothing could be farther from the right than the injunction, "Feed a cold and starve a fever.'' A cold is a fever, the inflammation being localised in the respiratory mucous membranes. Overloading the stomach is directly harmful, and meats, gravies, fried stuff and richly spiced food are especially to be avoided.

One should take freely of fluids. A milk diet for a day or so is advisable for those who have no antipathy to milk, and those who have may overcome it in a measure by taking the milk well diluted with Vichy water. Fruit is allowable, and fruit juices in the form of orange, lemon or grape fruit, or cider should be given freely.

In the very beginning of a cold it is helpful to bring about a free perspiration. This is most effectively done by drinking freely of hot lemonade punch, to which has been added a moderate amount of rum or brandy. A hot mustard foot bath or a general warm or hot bath may be taken also with benefit, the patient, going to bed immediately and wrapping warmly with blankets in order to promote good sweat. In the morning following, a saline laxative should be taken; an ounce of sulphate of magnesia, a Seidlitz powder, or a glass of magnesia citrate will answer the purpose.

During the acute febrile stage of a coryza, there is usually a tendency to lessened alkalinity of the blood. To combat this, alkaline treatment is advisable, which can be very satisfactorily given in the form of bicarbonate of soda, in twenty grain doses (about a third of a teaspoonful) every two hours in warm water. If there is fever, headache or joint pains, aspirin in doses of five grains, or phenacetin or salol in doses of three grains may be taken along with the soda. After the first two or three days soda is no longer of value.

Considerable benefit may now be derived from the internal administration of iodine. One may get for the purpose from the drug store an ounce of Lugol's solution and take about five drops in a half glass of water before each meal. No other medicine is to be taken at the same time.

During the first stage of an acute rhinitis, we should have respect for the highly sensitive state of the inflamed membranes and not attempt to use local treatment in any form. In the second stage, local treatment must be cautiously used. Steam inhalations containing menthol, or an oily spray composed of one per cent menthol and one per cent oil of eucalyptus in a liquid petroleum base tends to lessen the congestion, and has a generally healing and soothing effect.

With the onset of the third stage a more energetic scheme of local treatment is in order. Numerous alkaline and antiseptic solutions are on the market, each claimed to be the most valuable of its kind. They have all practically the same formula, the chief differences being in the flavour and colouring matter. If you do not want to pay for name and advertisement, you have only to apply at the drug-store for a few ounces of *alkaline antiseptic solution* (*N.F.*). It may be used in a dilution of one to three or four parts warm water, two or three times a day, running it through the nose by means of a medicine dropper or a douche rather than in spray form. When the inflammation is intense and the ears show evidence of being involved the alkaline douch may be followed each time by a few drops of ten or fifteen per cent solution of argyrol or a ten per cent solution of neo-silvol.

Certain other medicines are indicated for colds when complications have arisen. When there is decided involvement of the pharynx and painful swallowing, chlorate of potash is helpful; if there is tonsil inflammation with general aching of the muscles and joints, the salicylates in some form as salol, should be taken, and if the inflammation has spread downward as evidenced by hoarseness and cough, muriate of ammonia is advisable.

Two or three years ago, a method of treatment for colds by chlorine gas was widely heralded and great success claimed in certain quarters. Colonel Vedder of the U. S. Army, stationed at Edgewood arsenal, impressed with the report of the freedom from cold of employees in the plant producing chlorine, made some careful scientific investigations as to the effect of the agent upon certain bacteria. He came to the conclusion that the gas in a concentration that was harmless to the individual (viz. 0.015 m.g. per litre) had a decided bactericidal effect in acute respiratory diseases, in which the affecting organisms are located on the surface of the mucous membrane. We undertook to make some clinical experiments to test the practical value of this treatment, and came to the conclusion that benefit was frequently derived in simple uncomplicated cases of coryza, when treated in the first stage of the disease, but little effect was to be obtained when the sinuses or tonsils were involved, or when the inflammation had extended to the deeper layers of the membranes, rendering the bacteria inaccessible to the action of the gas.

With regard to the use of vaccines—the treatment of cold by this method is advocated and proclaimed by many physicians, despite the fact that, as we have attempted to show in another place (See Chapter VIII) it has little or no scientific foundation. That, apparently, very good results are sometimes obtained is probably due to mere coincidence. The profession is generally losing confidence in its efficiency and its popularity as a dependable method of treatment is fast dwindling.

XIII

NASAL OBSTRUCTION AND MOUTH BREATHING

Just as there are persons who go along for years with considerable near-sightedness or other defect of vision, and do not realise their imperfection unless perchance correcting glasses are fitted, whereupon a new world is opened to them; and just as an individual with one good ear may be unaware that the other one is deaf, until this fact has been demonstrated by a systematic test of his hearing, so too it is frequently the case that individuals go through life with insufficient nasal respiration, never realising that there is anything abnormal.

I have even found persons who because of completely closed nasal passages breathed only through the mouth and who seemed to think this was entirely normal. As in the case of sight and hearing, when we repair the defective function and restore his nasal respiration to its full physiologic capacity, the individual will rejoice and marvel at the gain.

There are many persons who theoretically appreciate the evil of mouth breathing, but who are fully unaware of the fact that they themselves are guilty, because the physiologic error is committed only at night and during the unconsciousness of sleep. Such a patient will indignantly deny the accusation of mouth breathing, but if he confesses that he awakens every morning with a coated tongue, parched lips and his throat feeling dry, a strong suspicion may be justly entertained despite the denial; and if besides you can get the testimony of an ear witness to the fact of snoring, the evidence is surely convincing.

The symptoms and evil effect of nasal obstructions will depend upon whether it is partial or complete. Stand before a mirror and take a number of quick deep breaths through the nose, and observe whether the nostril dilates, as it should, or contracts as it should not with each inspiration.

Normally with each act of inspiration the nares are dilated by the action of the muscles which supply the nasal wings, thus making a little wider the air passages at its inlet. But sometimes these muscles are paralysed or flabby, and in such a case the weak collapsed wings will be drawn in with each inspiration and the already narrow nares will become thus still further narrowed.

More often, the nasal insufficiency arises from diseased conditions which are to be found farther back in the nasal passages. It may be a simple catarrhal swelling, it may be a permanent enlargement of the turbinal bodies, it may be a cartilaginous or a bony spur which has grown out from the septum, or it may be due to a deflection of the septum. Any obstruction blocking one side of the nose for a long time, especially if it be of a permanent character, constitutes a cause of nasal insufficiency.

One of the commoner conditions producing a unilateral nasal stoppage is a deviation to one side or the other of the septum, the partition which normally constitutes a vertical plane, dividing the nose in equal halves. It is seldom perfectly straight but is usually bent a little to one side or the other, very often so much so as to compromise the space of the side toward which it is bent, sometimes completely closing it.

One might ask the question: would not the greater space produced on the side away from which the septum is bent compensate for the narrowness on the other side?

It does not do so because the deflection never involves the entire septum. The bend is chiefly in the anterior or softer part of the septum, the posterior portion, which is of stout unyielding bone, always keeping its place strictly in the middle line. Therefore, notwithstanding the spaciousness of the cavity, the current of air which can pass through is not appreciably increased.

Septum deviations, however, seldom consist of a single bend to one side, but generally there is a double bend, the so-called S-shaped feature, one convexity being toward one side, and the other toward the opposite, so that both nasal passages are more or less narrowed. It is quite common to find a curve to one side, complicated by a spur or outgrowth of bone or cartilage which further compromises the capacity of the side on which it occurs.

The amount of interference in the nasal breathing depends in a great measure upon the situation of the obstruction. The current of air passing through the nose in the act of inspiration does not follow a direct line backward, but its course is represented rather by a crescentic band, or arc which passes from the nostrils upward through the level of the middle meatus or channel and finally downward to enter the nasopharynx. A small swelling, located in the tract of this current, will constitute a considerably greater interference with nasal respiration than a large swelling located above or below.

Many persons suffer from a nasal obstruction which is not present all the time, but occurs intermittently. This may be the case when there are small polyps in the nose which vary with barometrical conditions.

Certain kinds of catarrhal swelling also have a tendency to fluctuate in size. The nose may be perfectly free now, and yet within a few minutes it will be completely closed.

There is a marked tendency for the stoppage to occur alternately first on one side of the nose and then on the other, and it will be influenced by such slight causes as a mere change in the position of the body. The patient afflicted with a blockage of this type, usually imagines it to be due to an accumulation of secretions in the nasal passages and he blows very forcibly to clear the nose, but without result. It is not due to any accumulation of mucus but to a swelling of the spongy tissues which make up, as we have already explained, a great part of the turbinal bodies.

Certain forms of catarrhal trouble are characterised by a lack of tone in the vessels of this spongy tissue, as a result of which they become too easily distended and filled with blood. There is, in other words, a lack of control with a resulting imbalance, and the erectile tissue may either shrink or become swollen without adequate provocation.

Children with adenoid vegetation in the nasopharynx will also exhibit changing nasal obstruction due to the variableness of this growth. They may be able to breathe thoroughly under normal conditions, but a slight congestion from any cause will produce a swelling of the growth sufficient to encroach upon the throat and the nasal passage and cause respiratory obstruction.

Mouth breathing is of course a necessity whenever there exists any disease, deformity, foreign body or growth which will produce complete nasal obstruction, so long as the obstruction lasts. If the obstruction be permanent, as well as complete, then the mouth breathing must become a permanent and fixed habit. Obstruction both complete and continuous can occur in children who have very large adenoids. In adults it is most often due to polyps or other tumors, or to irregular deflections in the septum. Whether it be complete or only partial, whether it be permanent or only temporary and intermittent, nasal obstruction is a very serious defect, because it interferes with the proper performance of a physiologic act of truly vital importance to the organism, one in fact so vital that it cannot be suspended for more than a few minutes continuously without death.

The slightest impairment assumes significant proportions when we take into consideration the accumulative loss in an act so frequently as well as so constantly performed. One breathes ordinarily about 26,000 times a day. In the course of a year the sum of respiration amounts to about ten millions. No matter then how slight the insufficiency of each single act the total loss is momentous.

In children the evil effects are to be seen in actual malformations of the chest. When the child must constantly tug for its breath, the resulting increased negative pulmonary pressure can exert a modifying influence over the soft yielding chest wall. Chicken breast and other malformation in children are produced in this way.

Mouth breathing is a wholly inadequate substitution for the nasal method of respiration.

One might, thinking of capacity only, wonder why as much oxygen could not be carried to the air cells by the mouth as by way of the nasal passages. But respiration, it should be known, is in a great measure an involuntary function, depending for its regular performance upon the reflex stimulation of the air cells by a properly prepared and purified air. Otherwise, breathing is superficial and fails to bring about the full interchange of gases between the air on one side and the circulation of blood on the other. Notwithstanding the volume of air, the blood is therefore not sufficiently oxygenated, and anemia is the consequence. The tissues of the body supplied by the thus impoverished blood suffer in their turn and thus it is that mouth breathers are constantly pale, weakly, undeveloped and ill-nourished.

One need only recall the important functions the nose has to perform as a respiratory organ to appreciate the evil consequences that mouth breathing has for the system in general and for the respiration in particular. The preparation of the air by filtering it, sterilising it, warming and moistening it, is a function which the nose only is able to properly perform. Let the air enter the mouth directly and it will soon abstract from the mucous membrane more heat and moisture than it can afford. The result is a general dryness and parching of the membranes with, of course, a great lowering of its vitality.

The dust and dirt deposited in the membranes cannot be gotten rid of as they are by the nose, and therefore remain to produce irritation and sooner or later inflammation. While the nose possesses certain germicidal properties, the mucous membranes of the mouth are, in this regard, utterly lacking. Indeed, examinations have repeatedly shown that while secretions removed from the interior of the nose are sterile, those from the mouth are swarming with bacteria of different kinds. It is estimated that 14,000 germs are taken in with each act of inspiration. In the peculiar construction of the nasal organs, nature has made wise provision for disposing of this vast army of invaders.

As this important protective function cannot be fully replaced, we cannot do otherwise than view with serious alarm the deflection of the inspiratory current from its natural channels, thereby opening a possible way to bacterial infection, which may be fraught with grave dangers, to the general health.

XIV

THE ADENOID PROBLEM

Intimately connected with the subject of colds is the adenoid and tonsil problem, for it is a universal observation that colds show a decided predilection for persons with diseased tonsils and especially for children with adenoids. (Fig. 10.)

Indeed, there is such a marked tendency for the child with adenoids to get a cold that this is regarded by physicians as one of the most convincing symptoms of their presence. Some of these little youngsters seem never to be free of cold, so closely one attack will follow upon another. They are in a constant state of "sniffles," due in reality to an inflammation of the adenoids, which has spread forward to affect the entire nasal cavity. The adenoid is an enlargement of the lymphoid structure in the post-nasal space. It is sometimes called the third tonsil, and is quite analogous in structure to the tonsils which are properly called the faucial tonsils. When this kind of structure once becomes enlarged and diseased, it constitutes a most vulnerable point of attack for hostile micro-organisms. There are a number of little pits or blind alleys opening upon the surface, and these become filled with a decayed substance (exudate) which is a breeding place for germs.

Here they multiply rapidly and carry on their nefarious activities without hindrance.

Naturally they soon overrun their boundaries and the neighboring structure becomes inflamed. An acute coryza or rhinitis follows their extension to the nasal chambers and the extension may proceed to the pneumatic spaces, setting up a sinusitis. The faucial tonsils being involved we are almost sure to have an extension thence to the pharynx (causing pharyngitis) and often to the larynx (laryngitis), or to the bronchi (bronchitis). The question is often asked as to what are the purposes of these lymphoid structures, and assuming that

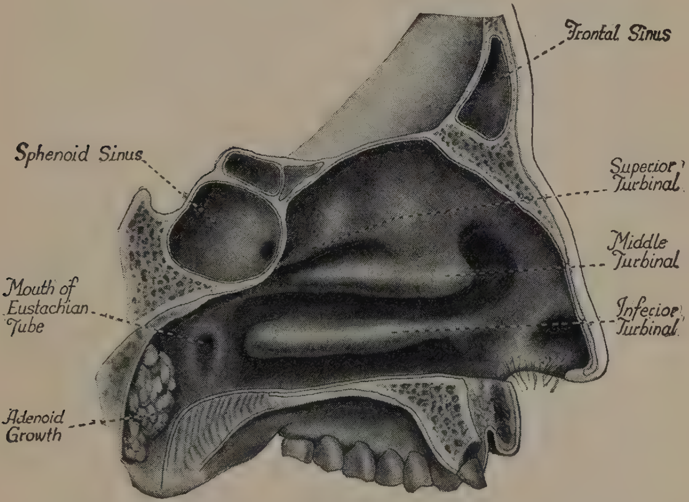

FIG. 10.—OUTER WALL OF NASAL AND POST-NASAL CAVITY

Lateral wall of interior of nose and of post-nasal space, to show usual location of adenoid vegetation. They frequently extend forward over the Eustachian tube and thus give rise to ear trouble.

they do subserve some useful purpose, the complementary question arises, will not their removal be followed by some untoward evil consequences. To the first question it must be admitted that we are still unable to give a definite answer. Several theories are put forward supported by experiment and reason, but each is disputed, and none absolutely proved. The chief theories for the reason of these structures are (1) That they are mere atavistic organs, of no use, (2) That they produce white cells that can absorb and destroy invading micro-organisms (phagocytic action) (3) That they produce white cells that enter the blood stream and form part of the cellular elements of the blood (hematopoietic action) (4) That they are of service in connection with voice production.

Most authors are inclined to hold that, considering their analogy with the lymphatic structures of the body, they are possibly intended to act, in some measure, as one of its defence mechanisms, but this with the modifying statement that the function is confined only to the earlier years of life.

Considering the special activity and tendency to overgrowth of these organs in the earlier years of life and noting their tendency to shrinkage or involution at the approach of adolescence, there seems good reason to believe with Harrison Allen that their function, whatever it is, is one closely related to growth and development of the bony framework of the body. The inference to be drawn is that while removal in the earlier days of life should not be undertaken, except for very positive evidence of harmful results, later in life their very persistence in hypertrophied form in itself makes them at least objects of just suspicion.

Whatever may be the functions of these organs at any time of life, and whether useful or not, these functions can only be performed in a perfectly satisfactory way if the organs remain normal and healthy.

In the state of disease in which they are so often found, they not only fail in their intended function, but, as pointed out, they have become a favourite playground for hordes of pathogenic germs,—which as a result of their activity pour continuously into the blood-stream poisonous toxins of evil import to the health of the body.

The mere frequency of the occurrence in children of the affection known as adenoids, even though it were esteemed of but little gravity, would be reason sufficient to demand for it serious and earnest study on the part of those interested in the physical welfare of the race. Estimates of the proportion of children affected differ, but they are all high. Some claim that its frequency amounts to as high an average as of one in every five children, though a fairer estimate of its prevalence is that it occurs in one of every ten. At least, every one will admit that it is a very widespread ailment, and that though here and there a family escapes, there are none who have not relatives, friends, or neighbours in whose family an operation has been found necessary.

But alas, frequency is not the only indictment we are compelled to bring against this affection. As you will surely soon discover, if you do not already know it, the existence of adenoids is fraught with the most serious consequences to the health of the individual, pointing eventually to the deterioration of the race. It stunts the growth and development of the child, and renders him a prey to every passing illness. It disorders his functions, robs him of his vitality, paralyses his faculties and generally impairs the physical, mental and even moral status of the unfortunate child that happens to be the subject.

The causation of the malady is but imperfectly known. It is common to hear it attributed to catching cold, and the occurrence of the various infectious or contagious diseases peculiarly incident to childhood. But it is more reasonable to consider the "colds" as effect rather than as cause, and as regards the other causes, I have seen numerous instances where adenoids in the worst form have been present in children who gave no history of eruptive fevers or of contagious or infectious diseases of any sort.

Such factors as dampness, bad air, and unsanitary surroundings are admitted as having an influence, but they are too general to be regarded as definite causes. One theory that has been advanced is that the ingestion of a surplus of sugar is responsible for adenoids, while another is that infantile habit of thumb sucking is the chief cause. But both lack proof and neither has gained the stamp of general approval.

Wanting a specific definite cause, some authors lay chief stress upon the existence of certain systemic dispositions of the body, probably congenital. There are good grounds for supposing heredity to have an influence, especially the fact of the frequent occurrence of the disease in several members of one family. My own observations have been that adenoids occur especially in families where one or the other of the parents has been affected with some obstructive condition of the nose. This may have been adenoids or it may just as well have been an irregular or bent septum, a septal spur, or a collapsed state of the wings forming the sides of the nostrils.

The obscurity which surrounds the causation, or at least the absence of acknowledged specific causes which one may lay hold on and eliminate, is but added reason for a more earnest attention to those symptoms and sequelae which might lead to its recognition, or that may be considered as indications for its removal.

For, unable to avoid the cause, our concern must naturally be next to escape, or at least ameliorate the effects. And when it happens, as in the case of the affection we are considering, that the most brilliant results attend our therapeutic efforts, how much the greater reason for the possession of knowledge which makes such an end possible.

In so many and devious ways can adenoids produce their ill effects upon the human system that there is scarcely any part of the body that can surely escape, and no organ that will be wholly exempt.

First, by obstruction of the nasal passages, they nullify and invalidate all the highly important physiological processes of nasal respiration. The constant entrance directly into the throat of unfiltered air causes the throat to be dry and parched, and leads eventually to a catarrhal state of the entire lower respiratory tract. On account of the unhealthy state of the mucous membrane, the functions of the lungs are imperfectly performed, the blood is insufficiently oxygenated, and general anemia ensues. Impoverished blood circulating through the system, explains the general debility anl malnutrition which these little patients usually exhibit.

Interference with the respiratory current is partially responsible also for the aural complications in adenoids, because the Eustachian tube which conveys the air from the nasopharynx to the middle ear cavity will in some measure be cut off from the normal supply. Under these circumstances the structures of the ear always suffer.

The situation of these growths, their proximity to important organs, explains many of the ill effects of their presence. When covering the mouth of the Eustachian tube they may completely invalidate the function of this organ. By inducing a congestion in the upper part of the nasal fossa and by compression they can interfere with the circulation and thus bring about congestion of the vessels at the base of the brain.

Probably in no other manner do adenoids give rise to so many and such serious disturbances, as by propagating infections. Upon microscopical examinations, they have been shown to swarm with bacteria, and being very vulnerable structures, which inflame upon the slightest provocation, it is natural that the germs should be incited often to increased activity, quickly spreading to other parts. Thus, travelling up the Eustachian tube, they set up a suppurative process in the middle ear, or passing downward they give rise to bronchitis and other inflammations of the lower tract.

Absorbed into the lymphatics they produce enlargement of the glands in the neck and under the jaw which are often found to be of a tuberculous nature, and are sometimes the seat of abscess formation.

Toxemia and acute general infections are said occasionally to have their origin in adenoids, and there can be at least no doubt that the infectious fevers peculiar to childhood are rendered more frequent and more severe because of their presence. The facial expression or configuration is usually modified to a very marked degree by the presence of adenoids and in its typical form it is highly characteristic. (Fig. 11.) The nose is narrow and pinched, the upper lip is generally short and often swollen and excoriated from constant nasal discharge. The mouth is nearly always open, so that the upper teeth are exposed to view. These are seen to be irregular, projecting, and discoloured. The eyes are usually lustreless and the general effect is to give a dull, stupid, vacant expression.

Children with adenoids, furthermore, are likely to be anemic, ill-nourished and undeveloped, and as they often have enlarged swollen glands in the neck, the effect is to give them the appearance of being "scrofulous." The speech of the adenoid child tends to betray him; the voice is lacking in resonance, being "woody" in effect; and the articulation is imperfect, because of impeded movement of the palate. He pronounces M like B, and

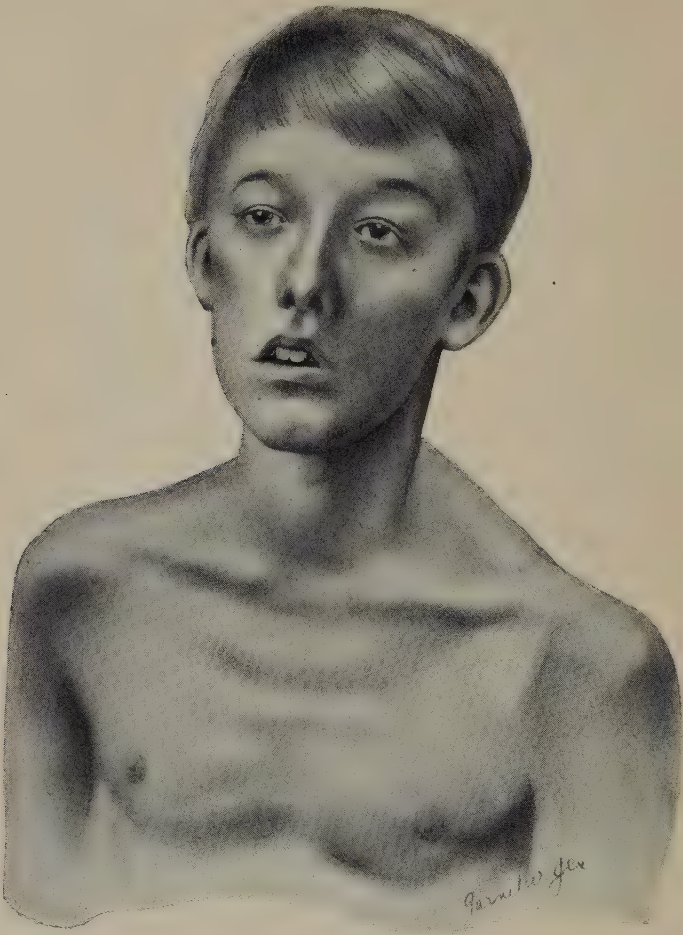

Fig. 11.—Child with Adenoids

Typical expression of face and formation of chest in neglected adenoid growth.

N like D. Thus the phrase, "fine morning if it don't rain," he would be apt to pronounce as though it were spelled "fide bordid if it dode rade."

If we would now look inside the mouth of our adenoid child we will observe instead of the normal Romanesque shaped palatal arch, a narrow, pointed arch of the Gothic type. Nearly always, too, we will find the tonsils enlarged.

The history in all these cases is generally as follows: The nose is more or less stopped; there is almost constant cold in the head; and nose-bleed occurs. The catarrhal symptoms are generally worse at night, and attacks of croup may develop; during sleep the mouth is kept open, and the breathing is noisy or there may be loud snoring. Whenever the patient contracts a fresh cold all the symptoms are aggravated, and especially a great abundance of thick yellow discharge escapes from the nose, or drops backward into the throat. In the latter case digestive symptoms arise as a result of the swallowed mucous.

Very prominent and very serious are the vocal symptoms which occur—hoarseness, loss of voice and spasm of the glottis. It is well known that a large proportion of the deafness of adults had its origin in adenoids which were not removed during childhood. Ear-ache is a quite common symptom, and should always in a child, give rise to a suspicion of adenoids. In many cases the aural trouble progresses to the stage of abscess formation, and in such cases, it is often impossible to get a permanent cessation of the discharge until the adenoids are gotten rid of.

That the presence of adenoids seems to make profound impression upon the general nervous system of the unfortunate little subject has been remarked by a great number of observers. In many instances indeed, the mental status is seen to be greatly affected, and the child not only looks stupid, but is actually possessed of a degree of mental lethargy or incapacity that seriously interferes with his school progress. Guye of Amsterdam was one of the first to note the influence of adenoids upon the mind, and in 1887 he wrote an article upon the subject and invented the term, "Aprosexia nasalis," to describe the characteristic mental condition which it produces. He emphasised especially the lack of memory, and inability to concentrate the attention observed in these children.

Some authors who have examined children in institutions for idiots and imbeciles claim to have noticed a significantly large proportion of the feeble minded who are afflicted with adenoids. The idea that adenoids can affect mental faculties is not a mere fancy, nor a bugaboo raised by the surgeon to frighten parents into having their children operated upon. It is based upon an actual demonstrated relationship which has been found to exist anatomically between the brain and nose. We know that the brain in part lies upon the roof of the nose, and if you will examine this roof you will see that it is a thin plate of bone, perforated by a number of holes, for the passage of the branches of the olfactory nerve; hence the name cribriform plate. Now certain German anatomists have found by careful dissection that the lymph vessels of the brain surround these nerve branches, and accompany them through the cribriform plate and into the nasal cavity. When conditions exist in the nose which cause compression of these vessels, the outflow of lymph is greatly obstructed and the cerebral activities are thereby greatly hindered, which may account for the headache, stupor and other mental symptoms so often observed.

Children with adenoids present evidence, moreover, of general nervous irritability. They are fretful, peevish, excitable or morose. Chorea, or St. Vitus Dance, as it is commonly called, may have its origin in adenoids, and nervous cough, spasms of the throat, and asthma may have a like causation.

Finally, as stated above, certain skeletal malformations are known to be produced by adenoids. One that has been especially remarked is what is termed the "pigeon breast" deformity. The author has seen marked examples of this and other chest deformities as a result of adenoids. They are due to the mechanical effects of obstructed breathing at a time of life when the walls of the chest are flexible, and thus more easily distorted.

Parents have a natural dread of having their child undergo an operation, and would avoid it if possible. They are inclined therefore, to listen to any one who will advise against it. They are told by some, that adenoids are normal, and therefore should not be removed. Luschka's tonsil indeed is a normal organ, but adenoids constitute an hypertrophy and are therefore not normal. Not only in this state must the organ be unable to perform any healthful function of its own, but, as we know, it is disturbing in many ways to the functions of other organs and gives rise to far-reaching systemic disorders of the most serious nature. Will the child outgrow adenoids? The most prevalent and the most persistent argument made against their removal is that if we leave them alone the child will outgrow them. This popular fallacy, which unfortunately to some extent has been encouraged by the family physician, when he happens to be one of little experience, is based upon the fact that the structure tends at the age of twelve or fourteen to harden and shrink. But if allowed to take this course, it invariably leaves behind an intractable nasal catarrh. And this is one of the least of the evils, for while waiting for the adenoids to contract, which they do not always do, incalculable harm is being done to the whole organism.

It will be impossible in later years with the most painstaking care, and with the most assiduous medical attention, wholly to remedy the evils which have been wrought by the continuous presence of these small growths. For the facial contour has become permanently altered, the teeth are distorted and diseased beyond complete repair, a chronic suppuration is present in the middle ear with all its attendant dangers, the throat and general respiratory tract is so weakened that colds are contracted upon the slightest provocation, and the poor unfortunate individual is the subject of weak lungs and, it may be, the victim of tuberculosis.

Especial emphasis should be placed upon the danger to the ears of leaving the adenoids alone.

A certain amount of loss of hearing is the sure consequence, the deafness will be progressive, and because of the attendant colds and catarrh, may reach a profound degree.

XV

TONSIL TROUBLES

Not less injurious to the health of the individual than adenoids is the presence of diseased faucial tonsils.

Being practically of the same structural formation they are naturally influenced by the same causes, and as a matter of fact we nearly always find an associated enlargement and disease of both the nasopharyngeal (adenoids) and faucial tonsils. Furthermore, as the adenoids block nasal respiration and make of the subject a mouth-breather, and as mouth-breathing tends to irritate and inflame all the structures within the oral cavity, the natural tendency to hypertrophy of the faucial tonsils is materially exaggerated.

But as the adenoids precede the arrival of enlarged tonsils, they also precede in the tendency toward atrophy, and now, after they have done their harm to the organism, they begin to disappear. The tonsils, however, with added instigation to inflammation and disease, go merrily on for years to come. As the adenoids, then, are the special problems of early life and childhood, the tonsils are a problem not only of those ages but also of adolescence and maturity. Fortunately they in turn tend to atrophy in the later years of life and therefore are of comparatively little trouble in old age.

Now, the tonsils have a set of troubles all their own. Outside of the tendency to repeated attacks of inflammation, generally in the form of follicular tonsillitis marked by filling up of the crypts with diseased exudate, and giving rise to the little white spots with which the surface is seen to be dotted, (Fig. 12.) they are liable to the formation of abscesses.

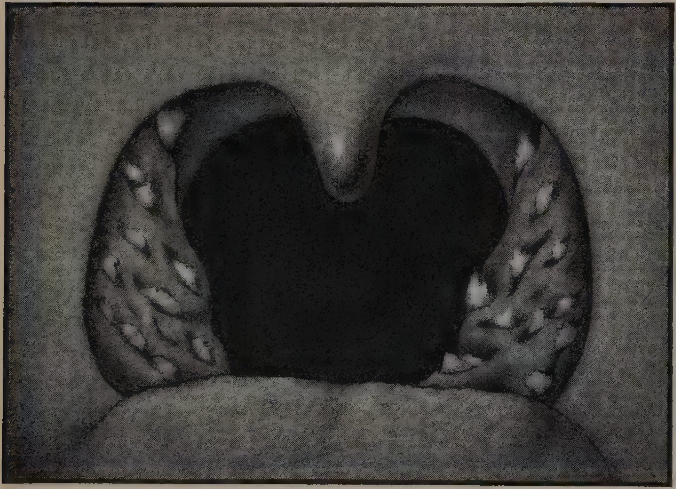

FIG. 12.—ACUTE CRYPTIC TONSILLITIS

The tonsils as they appear in a case of acute cryptic tonsillitis. The crypts or chinks in the tonsils filled with cheesy-looking masses made up of exudate teeming with bacteria, sometimes improperly referred to as ulcers.

"Quinsy" is the term used to describe that form of tonsil inflammation marked by abscess formation. If the abscess were confined to the tonsil itself, it would not be so bad, but the infection is apt to extend to the connective tissue lying outside the tonsil capsule, and then we have indeed the devil to pay. (Fig. 13.)

Peritonsillar abscesses, as they are called, are usually marked by intense agony, painful or impossible swallowing and systemic disturbance as well as local distress.*

Any one who has ever had a peritonsillar abscess need not quibble over the question of tonsillectomy. It is a positive indication for the necessity of the operation. Outside of the likelihood of a return of the attack it is a per se evidence of a chronic diseased state of the tonsillar tissue.

From frequent attacks of inflammation, the tonsils are likely to develop adhesions to the surrounding parts, and sometimes the outer surface becomes overgrown with adherent membrane. If, at the same time, they become more or less deeply sunken within the tissue, we have the most intractable form of tonsil disease, the so-called imbedded or submerged tonsil.

Such a tonsil, appearing to be small, is often

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* The death of Washington has been very generally ascribed to a sudden attack of quinsy. In an article however, which the author read by invitation before the Virginia Medical Society, in which all the records of the case were thoroughly reviewed in the light of modern laryngological knowledge, we believe we have conclusively shown that it could not have been a peritonsillar abscess, nor diphtheria, as others have diagnosed it, nor ordinary laryngitis nor pneumonia, but that it was an attack of acute edematous (dropsical) inflammation of the larynx due probably to a streptococcic infection. The immediate cause of death was suffocation from swelling of the tissue surrounding the glottis (the opening between the vocal cords) preventing the ingress of air to the lungs.

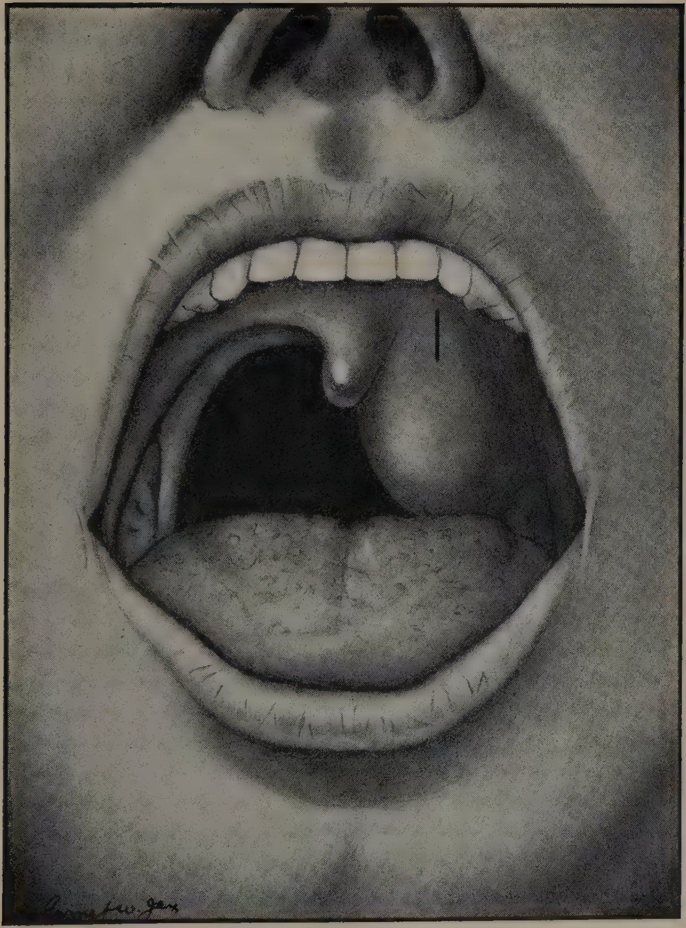

FIG. 13.—QUINSY

A case of Quinsy (peri-tonsillar abscess) affecting the left side; black line showing the usual site of puncture.

passed over by the casual observer as harmless, but it is in fact the worst kind, for, so shut in and imprisoned, it may become a veritable cesspool for blood-stream infection.

Tonsils give rise to more serious systemic disturbance than do adenoids, due to the more frequent occurrence of pus pockets, and the consequent toxic infection of various parts and organs of the body. The most common ailment directly traceable to diseased tonsils is rheumatism, and by far the most frequent cause of rheumatism is diseased tonsils. Any one who has had an attack of acute tonsillitis will recall vividly the rheumatic pains in all parts of the body, and especially the extreme joint soreness by which it is usually accompanied. The kind of toxin manufactured in the tonsils has an especial affinity for the serous linings of the joints, so that the so-called arthritic pains in any part of the body, (it may be in the finger joints or it may be so distant as the joints of the ankle or big toe) give good reason to hold the tonsil under suspicion. The kind of rheumatic pain particularly characteristic of tonsil infection is that affecting the muscles of the neck and shoulders producing a soreness and stiffness of the muscles in this region that is quite typical.

Yet more serious than any of these affections are the heart lesions which are liable to result from the tonsil infection. Sometimes the serous surface of the sac enveloping the heart becomes infected (pericarditis), and sometimes the inner lining of the heart (endocarditis), either one of which may place the patient in jeopardy of his life.

Kidney inflammation, high blood pressure, and general ill-health are frequently noted as coming from the same cause, when they are greatly benefited by prompt removal of the tonsils.

The general public is much given to being governed by fads in the cure of bodily ailments, and it must be admitted that the medical profession is not altogether immune from the same failing. Since it has been discovered that many diseases, formerly obscure, are traceable to a focus of infection lurking in some organ, doctors have been too prone to recommend the removal of tonsils, teeth or other organs, and the patients, very readily influenced, undergo operations that are the prevalent fashion.

We are disposed therefore to emphasise certain points that should be kept in mind in coming to a decision whether or not one's tonsils should be removed. Firstly, it must be determined by some one especially qualified whether the tonsils are diseased, and secondly, whether a given malady is a result of the disease. If one has been subject to very frequent attacks of tonsillitis the inference is in favor of chronic tonsillar trouble, and this inference becomes a certainty if the tonsil inflammation was of a type known as quinsy —that is attended with the formation of an abscess.

It must be understood, however, that in many cases the tonsils are not infrequently found to be badly diseased and septic, and so, likely to give rise to general focal infection in patients who are not conscious of any focal trouble, and who have seldom had sore throats. The expert specialist should be able easily to detect in such cases evidence of disease.

Whether or not certain ailments are the direct result of the tonsils is also a question for expert opinion, which will be governed in the first place by a general knowledge of what kind of maladies arise from tonsil disease, and a special knowledge of the particular kind of germ disease in the case, and also perhaps by the observation that the general malady in question will show exacerbation coincident with the increased local inflammation.

In the case of an operation that is so universally practised, by so many operators of varying skill and judgment, and upon patients of varying degree of bodily resistance, it is inevitable that a fatality may now and then occur, but it is an accident of very rare occurrence in the practice of those engaged exclusively in the specialty of laryngology. The author has removed thousands of tonsils, both in military and civil practice, operating on all conditions of life, in all ages from infants to old age, using all methods of operation, and yet he has not had a single fatal case to report.

The question which most often comes into the mind of every one, in connection with the subject of tonsillectomy, is as to the danger of bleeding. There is a wide-spread belief among laymen generally that the normal operation is a very bloody one, and that there is a possibility that one may bleed to death. Unfortunately, there has been some ground for the generation of this belief. It is to be found in the all too common practice of this operation by incompetent persons. In the great majority of instances, the removal of tonsils is indeed a simple procedure, but not always, because many variations occur in anatomical relations, and unusual difficulties may sometimes present themselves.

The general physician or general surgeon will "get away" with the successful performance of most of these cases, but is liable to have trouble with the exceptional one. The operation ought therefore, to be entrusted only to those who by reason of special knowledge and skill are prepared for every possible situation.

There is even a danger that the specialist may now and then become a little lax and less watchful than he should be, simply because in a succession of cases no accident has happened. It is important to stem all the bleeding at the time of the operation, and especially is it important that every precaution be taken to prevent a hemorrhage occurring later on. Nothing can be more distressing for a patient or embarrassing for a surgeon than a bleeding that comes on a few hours or a few days after a tonsil operation. It is exceedingly painful, with throat raw and sensitive from the recent operation, to have to submit to the manipulation necessary to stop the bleeding. Yet this must be done, or else in some cases the subject is compelled to take a general anesthetic, which was purposely avoided in the original operation.

There is only one way which surgeons recognise as offering a satisfactory guarantee against hemorrhage connected with tonsillectomy, and that is by a thorough tying or ligation applied at every bleeding point. If this be true, it is naturally a question why this is not generally practised. The answer is that the application of ligation in the tonsil is not always an easy procedure.

There are surgeons who confess to an inability to perform the feat, which is especially difficult for individuals with short, stubby, unflexible fingers. One of the most satisfactory ways that has been found to secure a vessel, is by passing under it a needle with a thread which is then tied around it—the suture ligature. But there is danger that the needle may snap under the pressure of the needle holder, which may prove a very serious accident.

To obviate these difficulties, the author has devised a special instrument, which makes it possible to place a suture readily in any desired place in the tonsil fossa. As soon as the thread is in place, it may be tied by a special knot without the necessity of, at any time, placing the finger within the oral cavity.

In a published article, "A method which insures the practical control of hemorrhage in connection with the operation of Tonsillectomy,"* we described in detail our method of the procedure of tonsil operation, which if conscientiously and intelligently followed, practically guarantees against the danger of tonsil hemorrhage. It consists in the placing of sutures as a routine practice at certain designated points, which anatomical studies and experience show to be the usual sites of bleeding. (Fig. 14.)

In order to be able to employ this method with facility, it may be necessary to devote a little time to acquire a thorough knowledge of its technique. But is it not time well spent, if it proves the means of preventing a great part of the serious post-operation hemorrhage, not to mention the possibility of sometimes, perhaps, actually saving life?

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* *Medical Journal and Record*, N. Y., August 17, 1927.

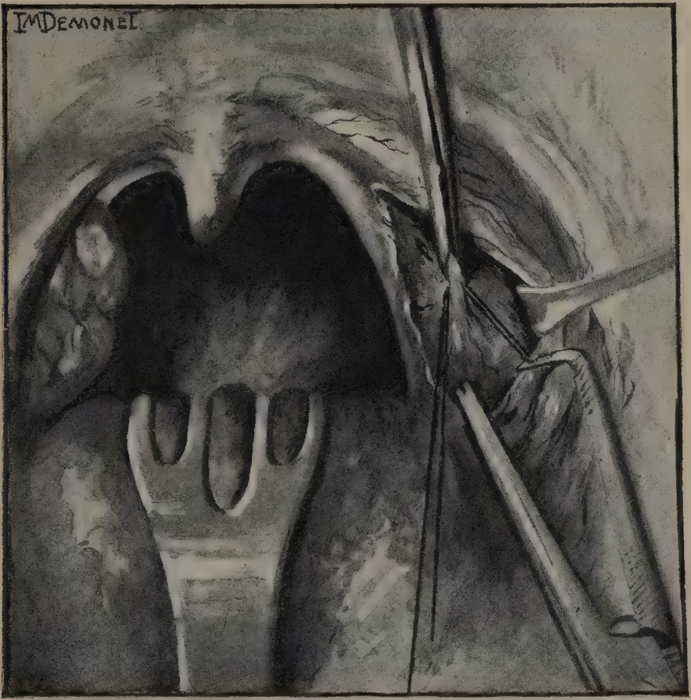

FIG. 14.—LIGATURE OF VESSELS IN TONSILLECTOMY

Showing the author's special method of suturing the vessels in the tonsil wound after tonsillectomy to prevent hemorrhage.

The operation of tonsillectomy may be done either with a patient in a state of unconsciousness from a general anesthetic or with the sensation to pain deadened in the region to be operated upon, by a local anesthetic. It is proper, instead of making general rules, to individualise for each separate case. There are some individuals who are not good risks for a general anesthetic and who had better have the local; there are others for whom the operation by local anesthetic would be totally unsuited.

The question is frequently asked whether or not diseased tonsils may not be brought back to healthy, normal condition by some kind of treatment, thus altogether avoiding the much dreaded operation. Any one who understands the pathology and physiology of these organs knows very well that it is impossible to accomplish this by the use of any medicaments locally applied. Gargles, sprays, swabbing are useful in combating superficial acute inflammation but powerless against the deep lying infection of chronically diseased organs.

The crypts of the tonsil penetrate deeply and, in diseased tonsils, they contain a pathologic exudate or pus, which explains the reason why the former method of clipping the tonsil proves a failure. The use of caustics or the electric cautery was even worse than insufficient, in that it often seared over the mouths of the crypts and imprisoned the diseased secretions. The same can be said of a method more recently brought forward under the name of electro-coagulation. For this purpose a high-frequency machine is used, generating a

D'Arsonval current which can bring about a limited destruction of tissue.

A few years ago, much hope was raised by the claims of x-ray specialists, that by exposure to the rays we had a substitute for tonsillectomy. This expectation, however, has not been fulfilled, chiefly for the reason that it is not possible to concentrate enough of the rays upon the tonsil to produce a satisfactory atrophy without injury to the overlying skin and surrounding parts, especially the parotid gland. The objection, however, is largely overcome in the use of radium, which by a method originally described by the author can be inserted in the form of needles directly into the substance of the tonsil.

We demonstrated to our satisfaction that it is practicable to bring about complete atrophy of the tonsils if the procedure is properly carried out and repeated when necessary. The tonsils in fact consist chiefly of a mass of lymphoid tissues, very susceptible to radiation, and when they have been treated in this way and later subjected to microscopical examination it was found that the spongy diseased tissue had undergone actual atrophic changes and converted into fibrous tissue imitating Nature's own method of normally bringing about recovery.*

In some instances there was considerable reaction, though slight as compared to tonsillectomy, and this can be made still less by giving smaller doses more often repeated. We have had a number of cases in which the atrophy was so complete that it was impossible not to believe that the tonsils had been removed by tonsillectomy.

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* On the use of radium to induce atrophy of the faucial tonsils —Histologic Evidence. *The Laryngoscope,* St. Louis, Sept. 1923.

It must be clearly understood that there is no method of removing the tonsil that is quite as satisfactory as the cutting operation. There are, however, certain cases when such operation cannot be undertaken, or where a general anesthetic is contra-indicated. In this event radium may be advisable.

XVI

THE SINUS SITUATION

In the chapter "Anatomical Outlines" we have briefly described a group of air chambers hollowed out of the bones of the face and skull and designated as paranasal or nasal accessory sinuses, because they surround on all sides the nasal chambers, forming as it were, hollow outshoots from these central cavities with which they are in direct communication.

The term sinus, it is evident then, is not to be confined to the cavities in the forehead, as many seem to suppose, but refer equally to the cavities of the cheek bone, (maxillary sinuses or antra), the honeycomb-like mass of cells which lie between the eyes (the ethmoid) (Fig. 15.) and the cavities situated above and back of the nose at the very base of the brain, (sphenoid sinuses). (Figs. 2 and 5.)

In the chapter "Symptoms, Complications and Sequelae," we pointed out how easily these sinuses might become involved by extension of the inflammation from the nose, and we indicated by what symptoms and signs, the involvement was evidenced.

So important is the rôle of the sinus in the tragedy we call catching cold, that it merits particular attention. More often than any other thing it is sinus disease that is the "nigger in the wood pile." Whenever a cold is seen to be of unusual severity, or when it persists with unusual obstinacy or displays an annoying tendency to recur with slight provocation, it is more than half a chance that the explanation is to be found in some involvement of one or the other of the sinuses, or it may be several of them together.

Sinuses tend to maintain and aggravate the symptoms of a cold by acting as reservoirs for the secretion which overflows into the nasal cavity and often backward into the nose, giving rise to the annoying symptom of "dropping" of which the patients often complain.

Secretions remaining pent up in the sinuses, become stagnant, and, if infection is added, undergo decomposition, and become of a more or less purulent character. This infection may spread to the neighbourhood of the nose, and to the other sinuses.

Let no one "lay the flattering unction to his soul" that he must be free of sinus trouble because he is free of pain. Except with the frontal sinus, pain is by no means a regular symptom, and is generally absent when the sinus disease has become chronic. It is not infrequent to find persons who for years have been going about with one of the sinus cavities filled with purulent exudate, and its bony wall badly decomposed, who have no local symptoms other than perhaps a persistent catarrh, or the symptoms of hay-fever. Unfortunately even the x-ray sometimes fails to disclose these suppurative foci and occasionally physicians as well as patients overlook them as a cause or as a source of an obstinate rheumatic condition, or of a general bad state of health.

The nasal accessory sinuses are regarded by some authors as mere vestigial remains of organs which in the lower animals and in primitive man had important olfactory functions. Originally they formed a part and parcel of the nasal cavities which communicated with them through wide openings, but as their usefulness as olfactory organs lessened, they became gradually walled off, leaving only small communicating apertures or channels, which we can readily understand must be maintained in order to provide ventilation and drainage of cavities still lined with functionally active mucous membranes. If the vestigial character of the sinuses be accepted, it follows that this must explain on the one hand their reputed vulnerability to disease, and on the other their incapacity for complete repair after extensive injury.

The mucous membrane of the sinuses differs from the mucous membrane of the nose in degree rather than in kind. The glandular elements and nerve filaments are less numerous, and the blood supply to the submucosa less abundant. Not only, however, is the layer of epithelial cells (the most superficial layer) thinner, but especially to be noted is the fact that the underlying so-called genetic layer of the epithelial surface is less substantial, all facts pointing, it seems to me, quite significantly to a lessened power of regeneration on the part of the submucosa.

Therefore from histological as well as develop-mental considerations, arguments are to be drawn which speak strongly against extensive operative intervention and in favour of extreme conservatism in dealing with the nasal accessory sinuses.

The maxillary sinus (antrum) is present in but a very rudimentary form at birth; its final shape and normal position are not obtained until after the eruption of the permanent teeth. The frontal sinus is not present at all at birth; it makes its first appearance at about the second year, and, only at about the eighth year, assumes the form of a distinct cavity. The ethmoid and sphenoid sinuses are present at birth, but like the others, develop slowly and do not assume their complete form and size until puberty or even later.

These nasal accessory sinuses in the adult are variable with regard to form, dimension and capacity, and the situation of their apertures. In general, however, we find that they have taken together a volumetric capacity equal to twice that of the nasal fossae proper, and, normally, each sinus will have at least one aperture of communication, through which the mucous membrane covering its wall becomes continuous with that lining the nasal passages. As pathological processes tend to spread by continuity throughout any homogeneous structure, it is nothing more than we could expect that inflammation affecting the nasal passages should involve the sinuses. The inference to be drawn is that in the treatment of sinus diseases, due attention must be given to securing at the same time a healthy condition of the nasal passages proper.

When the openings of the sinuses are in proximity, infection of one of these cavities from the other is always imminent. Therefore, the frontal, anterior ethmoidal and the maxillary sinuses, which constitute the anterior group and open near each other are frequently observed to be concomitantly diseased. Similarly, we find the posterior ethmoidal cells very often involved in cases of suppuration of the sphenoid sinus, or vice versa, because these two constituting the posterior group, open near each other in the region of the superior meatus. Capillary attraction and syphonage are probably the active forces in causing a spread of the purulent infection.

In addition to the fact that certain of these sinuses are in such intimate anatomic relation through their cell walls and ostia, another fact arguing for their mutual pathological dependence is to be found in their common vascular and vasomotor supply. Causes which act through these media are likely to influence simultaneously, in greater or lesser degree, the entire nasal accessory system.

The obvious deduction to be drawn from these considerations is, of course, that treatment of any kind, restricted to a single sinus, may prove futile so long as a neighbouring sinus continues to suppurate. Radical measures, once decided upon, will therefore often have to be much more extensive than originally contemplated.

The maxillary sinus, (antrum) in addition to those causes common to other sinuses, is in a certain proportion of cases affected by caries of the roots of teeth, which are in anatomical relation with its floor,—most commonly the second bicuspid and first molar. The dental origin, formerly regarded as responsible for about one-half of all antral suppuration, seems to have lessened as a factor and according to later statistics can hardly be incriminated for more than one-third of all cases.

Of great interest in connection with the treatment as well as the genesis of sinus inflammation is the size, conformation, and especially the situation of their ostia, or apertures of communication.

Looking at a sagittal section exposing the lateral walls of the nose, we observe that the frontal sinus has its outlet at the most dependent place so that the secretions will fall downward through a narrow channel, opening either in the upper part of a slit known as the hiatus semi-lunaris, or just anterior to it.

The opening of the maxillary sinus, which may be seen in the lower posterior end of this hiatus, instead of being at the most dependent locality is situated, on the contrary, near the roof, so that when the patient is in the upright position no fluid can flow out by force of gravity until the cavity is practically full.

The same is true also of the sphenoid, whose opening may be seen in the superior meatus on the upper part of the anterior sinus wall.

Much has been made of these various positions on the ostia relative to the sinus cavities. The deduction generally made with regard to treatment is that, while a frontal sinus may be depended upon to get rid of a purulent collection because of the favourable situation of its outlet for drainage, the case is hopeless for the antrum and the sphenoid unless surgical measures are resorted to. To hold such a view means to have far too little confidence in the resources of Nature, who has provided other means for the emptying of the sinuses than gravity alone.

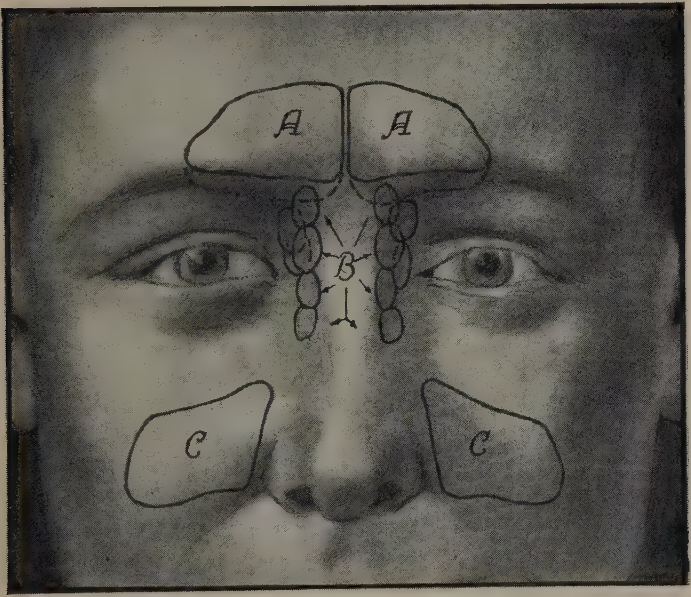

FIG. 15.—POSITION OF SINUSES

Diagrammatic representation of the position of the nasal accessory sinuses:

A—Frontal sinuses
B—Ethmoid cells
C—Maxillary sinuses (antra).

Skillern has shown that if finely powdered lamp black is strewn over the mucous lining of the sinus of freshly slaughtered calves, the black particles may be observed to travel the space of 1 cm. per minute toward the ostium, no matter what the situation, and that in a short time it will have completely escaped into the nasal cavity. This is without doubt the most potent force in ridding the sinuses of contained secretion. The mucous membrane of all the nasal accessory sinuses is of the ciliated type. The fine hairs or cilia are in rapid and constant motion and always towards the sinus opening.

The waving of one of these cilia described elsewhere is estimated to occur at the rate of about twelve times a second, the forward movement being twice as rapid as the return. Warmth and an alkaline reaction of the secretions favour their activity, whereas cold, too great acidity and irritant chemicals have a retarding effect. We see, therefore, in the action of these cilia a powerful force overcoming the laws of gravity. We see at the same time the necessity of their integrity being maintained and of the importance of securing a proper environment for their activity, from which facts we may not only draw general arguments in favour of conservatism, but also some practical deductions for local treatment.

It shows the advantage of bringing into contact with the membranes no medicaments which have not been warmed; and if in solution they must be alkaline and bland, never strongly irritant. When the secretions become thick, viscid and abundant, ciliated action is embarrassed and their removal is consequently a rational indication.

In the plan of the lymphatic distribution, unlike the case of the blood supply, there is no reason for the common involvement of the sinuses or the extension of disease from one to the other. The lymphatics, forming an interlacing network over the walls of the individual cavities, seem to radiate in each case towards the ostium, where they communicate with the nasal fossae. They are no doubt a part of a protective mechanism, and acting in conjunction with the ciliated cells, tend to relieve the cavities of exudate and epithelial debris, which accumulates as a result of inflammation of its lining walls. The direction of the flow being toward the nasal cavities, inflammatory engorgement within the latter will naturally impede this wholesome draining process, produce stasis or blockage of the lymphatics of the sinus, and thus favour bacterial invasion.

In addition to the action of the ciliated cells of the lymphatics, certain physical forces, according to Yankauer, may be counted upon to promote the evacuation of the sinuses. These are especially capillary attraction and syphonage. Through adhesiveness of the secretion to the sinus wall, assisted by ciliated action of the epithelium, an accumulation of fluid in one of the sinuses will never be perfectly level, but have always a high meniscus reaching as a rule to the ostium. Then capillary attraction and syphonage come into play, the former favoured by the conformation of the ostial edges, the latter by the continuity of the secretions within the cavity, with what has escaped into the nasal passages through the natural orifice of communication.

Now apertures of the sinuses are maintained evidently by nature for another function besides that of draining away the secretions. As we have already mentioned, there was a period in physical development, when the sinuses widely communicated with the nose and were constantly in contact with the inspired air. It is for this reason probably that air is still a necessity for their normal health and vitality. Just as the tympanic cavity becomes congested and diseased when its normal supply of air is cut off by obstruction of the Eustachian tube, so the nasal sinuses suffer when the ostia become in any way occluded. The air in the enclosed cavity becomes gradually absorbed, and the resulting rarefaction tends to produce a sagging in of the yielding membranous lining attended with marked passive congestion. If in such a case a purulent secretion is already present in the cavity, microorganisms of a parasitic character (so called saprophytes) multiply and bring about a decomposition of the stagnant secretions. It is quite likely that the severe pains experienced in some cases of sinusitis may be due to the pressure of gases arising from the decomposition of pus. How many physiological facts seem therefore to point to the positive necessity of keeping these ostia clear, as one of the prime indications of sinus treatment?

The bacteriology of the sinus is a topic of great interest, closely related to the subject in hand, but unfortunately, though much has been written, very little has resulted of practical value. The normal sinuses, contrary to our former opinions, have been shown by more recent investigations to be nearly, if not completely, sterile. Experiments seem to prove that the mucoid secretions, if they do not possess actual bactericidal properties, at least are capable of inhibiting bacterial growth.

A great variety of micro-organisms is found in sinus suppuration and no one can be rightly called the specific cause. An inflammation which may have begun with a certain micro-organism predominating will often later on show an entirely different one taking its place, and it is the rule to find mixed cultures, in a suppuration that has lasted any length of time. For these reasons, if for no other, vaccine treatment of sinus inflammation in the chronic form must be regarded as somewhat chimerical.

Pyogenic cocci seem more often associated with sinus suppuration than baccilli. Those most frequently found are the pneumococci, streptococci, staphylococci, and diplococci.

While many infectious diseases are complicated with sinusitis, in most instances they must be looked upon as only predisposing causes, preparing the soil, as it were, for local infection. Exception must be made of four diseases in which apparently the sinus inflammation is directly and primarily due to the specific organism of the disease. These are influenza, croupous pneumonia, diphtheria and erysipelas. Of these by far the most frequent cause is influenza, whose importance as a cause of sinusitis was first pointed out by Lindenthal and later emphasised by Hajek.

Since sinus trouble was unknown a generation ago, and now seems to be an exceedingly prevalent infection, it is often wondered if it is a new disease, or if our forefathers also had it, and, if they did, how they made out when so little was known about it. It is certainly not a new disease. We have always had our sinuses and it is natural to believe that they were susceptible to disease in generations gone by as they are to-day. But in recent times on account of new technique and methods of examination we have been able more easily to discover a diseased condition here, and have found it is of rather frequent occurrence.

In former days patients suffered without knowing what they suffered from, and their afflictions were included in such general designations as neuralgic colds, catarrh, abscess and migraine. To-day the exact nature of the trouble may be at once recognised, and if properly treated, may be promptly relieved and eventually successfully cured.

To effect a permanent cure in a chronic case with necrosis on decay of bone, a radical operation may be necessary. This requires free opening of the cavity and exposure of the diseased part,—and can be properly done only by a skilled surgeon.

XVII

VOICE AND SPEECH

A word may be added as to the effect of cold on that part of the respiratory tract which is the seat of the voice. This is a matter of great importance to singers, public speakers, and actors, because a cold settling in these parts hits directly at their capital or means of livelihood.

There are some individuals, in whom a cold shows a predilection for the larynx, striking there first of all as a place of greatest weakness, but as a rule the cold begins above, either in the nose, or in the tonsils, and then spreads downward to involve the voice-producing organ.

There can be no doubt that straining the voice from excessive use, or bad methods of voice production have much to do with rendering the larynx susceptible to attack, for the congestion induced from such causes is added to the congestion from the usual cause of cold.

Any condition which obstructs nasal breathing is very harmful to all the lower parts of the respiratory tract, including the larynx, for in such cases the unfiltered and unpurified air comes directly in contact with these parts, bringing with it dust particles, and disease germs. Mouth breathers have nearly always irritated, dry throats and a rough hoarse voice.

The inhalation of irritant fumes and gases must be mentioned as a predisposing cause of colds of especial importance in laryngitis. The habit of inhalation in smoking is therefore carefully to be avoided with persons who value their voices

The larynx is that part of the respiratory tube which has undergone special modification in order that it may at the same time become the seat of the organ of phonation or the production of sound. In order to serve this latter purpose, the tract becomes narrowed, especially at the location of the vocal cords. At the moment of phonation there is almost complete closure so that during the act of phonation the respiratory functions are temporarily in abeyance.

As explained in Chapter III, the vocal cords do not open throughout their entire length, but remain fixed at one end, while the other two ends move away from each other. The opening thus produced which is naturally of a triangular shape, is called rima glottidis, or chink of the glottis, and is sufficient for the current passing to and fro in the act of respiration.

As respiration can take place only when the cords are open and as their approximation is essential to sound production, it is evident that the respiratory muscles are openers of the glottis, and must be regarded as antagonistic to the muscles of phonation, or the glottis closers. It is a remarkable fact that nature has depended upon one small pair of muscles for the former important function, while quite a number co-operate in the latter.

It is fortunate that it seldom, or never happens that both of the cord openers are paralysed at the same time, for if they should be, the glottis would keep closed from the ordinary tension of the phonation muscles and the patient would suffocate.

It is to be noted that there is an essential physiological difference in the acts of respiration and phonation, which involves an essential difference in the government of the muscles of the larynx connected with these two functions. Respiration is, like heart function, an involuntary one, which goes on night and day without any intervention from the conscious will. Phonation on the contrary is directly under the control of the conscious forces of the intellect and so we speak only when we will.

Now it is a well known physiological principle that involuntary processes of the organism derive their chief nervous control from centres situated not in the brain but in the upper spinal cord, while with the voluntary function the reverse is true.

Therefore we understand that the chief centre for the muscles which open the glottis, a respiratory act, are in the spinal cord or medulla, though since the will may intervene, as when we wish, for example, to take an extraordinary deep breath, or for a moment hold the breath, there exist also cerebral centres, though generally latent and inactive. On the contrary the chief centre for phonation is in the brain where originate the impulses which act upon the complex muscular mechanism of the larynx to produce the various vocal effects. In this view, voice production may be regarded as a mental process, the higher development and perfection of which can only be attained by intellectual training and education.

In the new-born babe, before the phonatory centres have become developed, the production of the voice is practically a mechanical process. One of the first things an infant does when he comes into the world is to use the vocal cords, and during its early years this exercise is practised to the utmost, for its sole language is the cry and this bursts forth spontaneously, in response to irritants of a thousand kinds. Thus in the new-born the spinal centres are most active and remain paramount; the higher centres exerting but a feeble control at first and only later, as the intellect develops, coming to have a dominating influence. This relatively overwhelming rule on the part of the spinal cord explains why infants and young children have such a tendency toward spasmodic croup, and laryngismus stridulus,—for mechanisms which operate thus through the spinal centres are known to be less stable and more liable to reflex, especially when the inhibitory influences from the cerebral cortex have not asserted their control.

It is of the utmost importance that we do not confuse in our mind the concept "voice" with the rather more inclusive concept "speech." Voice may be defined as the raw material out of which speech, the finished product, is manufactured. Originating in the vocal cords, it is through the intervention of the palate, tongue, lips and teeth that the simple elementary sounds become eventually moulded into articulate spech. Voice in its original state is composed of vowel sounds only; speech requires the addition of consonants, which are nothing more than various interruptions of the pure sounds by the organs of articulation.

Speech is an intellectual process, being the chief instrument for the communication of our ideas; voice expresses emotion only. Speech, some cynic has said, was made for the purpose of disguising our thoughts; few, however, can avoid being betrayed by the voice, for, as the old adage informs us, "the tongue may lie but the voice will tell the truth." In other words, though the lips speak falsely, the "tears in the voice" must betray the ill-concealed emotion of the speaker.

The voice has been called the mirror of the soul, so truly does it reflect its inward workings. Anger, sadness, modesty, joy, sympathy, how exquisitely and unfailingly are these emotions expressed. The dramatic artist understands this well enough, and is as careful to impress the audience by the voice suited to the part as by the facial make-up. The gruff voice of the hardened tyrant, the soft, gentle voice of the heroine, the drawl of the comedian, and the sweet silvery tones of the lover are familiar enough to us all; and in the old-fashioned melodrama, too, you will surely not fail to hear the hissing voice that escapes between the closed teeth of the detested villain.

A good speaking voice is without doubt one of the most valuable assets a man can possess, no matter what may be his occupation or main purpose in life. To the lawyer, lecturer, actor, teacher, clergyman, legislator, it is of course an absolute and indispensable requisite, but to persons in all walks of life, it is a highly desirable endowment that has much to do in determining a successful career. In the world of business, science, education and politics alike a pleasing address is acknowledged to count for much. The persuasive voice will overcome opposition; confident tones convince adversaries; a sympathetic accent will make friends, where timid, unfeeling and uncertain speech, using the same words and advancing the same arguments, would fail.

It cannot be denied that the harsh, rasping voices of some men repel, and the shrill, strident voices of some women, "get on the nerves." That we judge men and women by their voices is too well known and accepted to require insistence. This being so, we have only to insist that the voice be preserved in all its original purity and prevented from deterioration; that its disorders be quickly corrected, and the causes leading thereto promptly and thoroughly removed. For, while it is a great advantage to have a normal voice, flexible, expressive and capable of conveying the very ideas, and producing the very impression that is desired, on the other hand it must be counted a great misfortune if it be so altered by diseased conditions that it not only fails to do this but actually does the reverse, misrepresenting the sentiments, belying the disposition, and giving false impression of one's mental and moral attributes.

To understand the defects to which the voice may be subject, it is necessary thoroughly to understand the mechanism of its production; and to arrive at the causes which can produce these defects we must be familiar with both those influences which operate from without as well as with the pathological alterations which exist in the vocal organs themselves. In considering the local causes of voice troubles, it may not be out of place to correct a misapprehension on the part of some, at least, who are in the habit of regarding the larynx as the sole organ of the voice.

If we compare the larynx to a violin, the strings must be represented by the vocal cords, and the body of the violin which gives character to the instrument, by the pneumatic spaces below and above, including the oral and nasal cavities. The motive power, which in the case of the violin is the bow drawn across the strings by the skilled hand of the artist, is represented in the human organ by the expiratory blasts proceeding from the lungs. Corresponding with this three-fold composition of the vocal organ, we have a trinity of voice qualities, which form a natural basis for our study of its defects.

First, intensity, or the dynamic quality, is derived from the force and power of the lungs, or bellows. That a proper development of the lungs is essential to a voice of normal intensity is manifest and need not detain us long. Those who have to use their voices for prolonged discourse, or in singing, need a full chest capacity not compromised by any pathological conditions within or without which compress the lungs. Any disease of the lungs, as tuberculosis, soon makes itself felt in shortness of breath, when this is called upon for the function of phonation in addition to respiration. Out of breath, out of voice, is a self-evident proposition. We witness it in asthma, tuberculosis, pneumonia and various other affections.

Second, pitch is a quality which originates in the varying tensity of the vocal bands opposed to this expiratory air current. The quality of pitch is almost, if not quite wholly, a function of the larynx and it is, therefore, in the larynx that we must look for the cause of its disorders. Pitch depends upon the number of vibrations which reach the ear within a given time; the more numerous the sound waves the higher the pitch, and vice versa. The vocal cords by a wonderful arrangement of muscles are capable of undergoing modifications in thickness, length, and tension, whereby vibrations of greater or less amplitude and frequency are produced. This is done chiefly by the intrinsic muscles, while certain others situated outside the larynx may modify the shape, position and tension of the larynx as a whole, in such a way as to produce the different registers of the voice.

Third, timbre, a quality which is given it by the adjacent cavities. The timbre of the voice is that which gives it character and enables us to distinguish the voice of one individual from that of another. This function is performed to some extent by the cavity below the glottis, but to a much greater extent by the supraglottic cavities, the nose, throat, mouth and accessory sinuses. Acting as resonating chambers, they serve to reinforce the vibration emanating from the cords, and by their different size and conformation give to the voice its individual character.

Inflammation of the larynx, resulting from a cold, will be attended with a congestion of the parts, with occasionally a swelling of the mucous membrane surrounding the cord. The cords themselves are lined by a very thin transparent layer of mucous membrane, and in violent inflammation the cords will lose their normal white color and become pink or even deeply red.

When the larynx becomes acutely inflamed from a cold it is usually tender and sore, and painful on use of the voice, but the chief symptom indicating trouble there is hoarseness, of more or less degree.

If there is so much swelling between the cords that they cannot come together at all, there can be complete loss of tonal character to the voice which is reduced to a whisper.

Sometimes there occurs a dropsical swelling of the membrane (edema of the larynx) which closes the glottis and produces suffocation.

It must be obvious, from what has been said of the special cause of laryngitis, that to prevent its occurrence it is most important to get rid of any obstructive disease of the nose and to remove diseased tonsils.

The inhalation of irritant fumes, and improper and excessive use of the voice must be carefully guarded against in the case of individuals with a special predisposition to laryngitis, and when one is suffering from an attack it is imperative that the voice be spared as much as possible unless you want to run the danger of having it permanently injured.

XVIII

SUMMARY AND CONCLUSIONS

The object of this work has been to set forth for the benefit of laymen, the best and most recent knowledge of the profession on the subject of the origin and nature of the common cold and its complications,—why we catch them, how we can avoid them, and what we can do to get rid of them.

If the information is not altogether satisfactory, it is because our scientific knowledge is not in all respects final. It is regrettable, that so little serious attention has been devoted by the profession to the conquest of this universal plague which lies at the root of so much morbidity and whose ravages cause such widespread suffering, not to mention the enormous economic waste resulting. Though there are many questions undetermined and debatable, nevertheless there are a number of facts upon which there is practically universal agreement.

First of all, it is necessary to strive to remove many false impressions with regard to the nature and origin of colds, and correct some absurd notions that are more or less prevalent as to their prevention and cure. To this end, a few basic facts in the anatomy and physiology of the organs concerned are indispensable.

The vital importance of nasal breathing cannot be too greatly emphasised. The delicate, highly specialised structures of the nose are formed to filter and purify the inspired air and, this failing, all the respiratory organs lying below, including the tonsils, larynx, and bronchial tubes, are injured by improperly prepared air, and therefore the easy prey of colds and infections.

One has only to consider that the special senses of smell, taste, hearing, the sense of orientation and the important function of speech, are located in the nose or its adjoining organs, to realise something of the disastrous results of diseases affecting these regions.

Where important functions lie, nature takes especial precaution to institute mechanisms of protection. Ignorance, neglect, abuse, are too often responsible for breaking down these defences, and then the upper respiratory tract becomes the entrance port for myriads of disease germs. Influenza, measles, scarlatina, diphtheria, pneumonia, cerebro-spinal meningitis, and probably also sleeping sickness and many other diseases, find their way into the system through the nose and throat, and are favoured by mucous membranes inflamed by the ordinary cold.

The causation of colds is a complicated question. There are two chief factors which are of equal importance as inciting agents, namely atmospheric conditions and micro-organisms, but in order that these factors shall be effective, the way must have been prepared by one or more so-called predisposing causes.

Predisposing causes, are subdivided into general and local. The general are those which appertain to the general state of the health, and the local are lesions of various kinds which are located in the nose and throat themselves. These predisposing causes being internal, are, in their turn, it must be understood, the result of certain external influences or conditions, and therefore, really represent intermediary stages in the chain of causation. The effective external conditions are especially such factors as impure air, drafts, irritating dust, overheated apartments, inappropriate clothes, excessive or improper diet, excessive use of alcohol or tobacco, etc.

The local predisposing causes of colds are of great importance, and constitute in many cases the chief explanation of continuous and repeated attacks. Any disease in the nose and throat lessens the resistance of the parts, and renders them susceptible, but certain ones are of especial significance. In the case of children, the commonest cause of colds is the presence of adenoids; in adults, the largest proportion of persistent and repeated colds can be traced to a diseased condition of one or other of the sinuses. Deviations of the nasal septum and other obstructive conditions within the nose do harm not only because of interference with proper nasal breathing but because they obstruct the outlet of the sinuses. Diseased tonsils and sinuses favour colds because they invite infection, which frequently spreads to adjoining regions.

Atmospheric conditions, it must be insisted, are real and very important influences in the mechanism of cold catching. Colds are commoner in cold weather and in cold climates, and animal experimentation as well as personal experience attest the influence of low temperature in inducing inflammation of the air passages. It is only natural to suppose that the air tracts designed by nature to ultilise air for the benefit of the human body, might be injuriously affected by unusual atmospheric states. As the nasal functions in particular are concerned with the temperature and humidity of air, and the variations to which they have to be constantly adjusted, we have one explanation of the especial frequency of head colds as a result of violent changes in these atmospheric conditions.

It must be remembered that the respiratory function of the nose has a reciprocal relation with the function of the skin, in connection with the heat-regulating activities of the body. This is made possible through the intermediation of the so-called sympathetic nervous system which automatically controls the circulation in these organs, in response to variations in the temperature of the atmospheric environment. Drafts are bad because they interfere with the orderly adjustment of these related functions of nose and skin. A cold column of air blowing upon restricted areas of a generally overheated body, while the individual is at the time inhaling warm air, provokes a congested condition of the nasal circulation, a forerunner of colds.

Notwithstanding the evident influence of bad atmospheric conditions in the causation of colds, it is certain that these are not alone a sufficient cause, but there must be added another factor, viz., the presence of micro-organisms. This is strikingly proved by the experience of arctic explorers who are exposed to the worst possible weather conditions with complete immunity from cold catching.

That acute colds are, in a measure, of an infectious nature, is generally admitted by the best authorities, but so far no germ has been identified as a specific cause. Most of the bacterial growth found to be associated with these attacks is a secondary occurrence and not therefore to be regarded as the real causative agent. For this reason vaccines derived therefrom are of no real value in the cure of the malady. It is very doubtful if any serum or vaccine can be found to prevent recurrence, for the reason that colds do not belong to that class of diseases distinguished by the peculiarity that one attack confers subsequent immunity.

The idea of the bacterial origin of colds naturally raises the question of their contagiousness. Colds are no doubt in a certain degree contagious by close contact, and especially by exposure to the cough or sneeze of affected individuals. However, emphasis should be placed less on contagion than on the resistance of the individual, for colds do not occur unless the resistance is previously lowered by predisposing causes of either a local or general character.

Similarly, with regard to the use of antiseptic sprays, vapour, douches, or gargles, with the idea of destroying bacteria and so preventing or curing colds, while they are, properly used, helpful, it must be understood that it is impossible to get rid completely of all germs, and therefore a chief reliance should be rather placed in so building up body resistance as to render the bacteria harmless.

The symptoms of a cold are known to everyone by personal experience. However, many persons take to be a cold what is only a mere irritation of the nasal passages, a sort of psuedo-cold, of a nature to be classed as hay fever or something similar. A lack of distinction in this respect has been often responsible for claims as to the efficacy of certain cold remedies which were not justified.

In the prevention of colds, we must take into consideration the nature and the intensity of the causative factors. It is of course imperative to avoid those of such severity as could not fail to break down resistance and cause disease,—atmospheric conditions of unendurable violence or infectious agents in overwhelming force. But all causes that fall short of a destructive degree must be faced, because this is the way we accustom ourselves to withstanding conditions that are inevitable and of building up against them our forces of resistance. In fact, for the avoidance of colds it is desirable that one should actively undertake special procedures which we speak of as "hardening," designed to train the forces of the body to withstand unfavourable influences.

In the practice of hardening we insist that certain principles be observed, (1) to accustom the body only to those weather conditions which may be regarded as inevitable in the ordinary experiences of life; (2) all hardening procedures should begin lightly, increase gradually and never be excessive; (3) whenever cold water is used for its hardening value, it is essential that a healthy reaction be obtained; and (4) hardening methods designed to prevent cold should never be employed during the existence of a cold.

It is not possible to enumerate in an exhaustive fashion every possible situation that has a bearing on the problem of colds. We may however cite a few practical rules of special importance from which others may be readily inferred, following the principles above outlined.

With regard to the atmospheric factor, we consider it important that one does not expose himself to a cold chilling air, when in a state of perspiration, or when greatly fatigued either bodily or mentally. One should avoid drafts when at rest in a close stuffy room. One should avoid at all times badly ventilated and badly heated apartments. There is an especial danger of contracting colds in those places in which the floor is cold and damp, and the upper strata of the room proportionately warm. Overheated apartments are one of the greatest evils of our American homes, and the most prolific cause of cold catching; but, on the other hand, there is danger in underheated living and working rooms, where the loss of heat from the body may go on insidiously with harmful results. There is especial danger in standing in cold halls or vestibules, or sitting quietly without exercise in cold places.

Getting the feet wet is a cause of colds familiar to us all since childhood days. The danger is much lessened by a prompt towel dry-rub of the feet, with change of foot-wear. The same thing applies to the clothes in general. Washington started the cold which ended his life by keeping on his overcoat for some hours indoors, although thoroughly wet from exposure to a snow storm.

With regard to the bacterial factors, it is probable that danger of exposure is increased by worry, and other depressing emotions, as well as by physical fatigue and a generally run-down state of the health. The danger of contagion is in the direct exposure to the mucous membrane secretion, as spread by kissing, the sneeze, cough, or the use of handkerchiefs or towels of infected individuals.

Proper clothes are of great importanace for those who would escape colds. One of the most valuable rules to be observed, is to wear, as near as possible, underwear of the same weight throughout the year. One must guard against over-dressing, especially against remaining too long indoors with wraps, overcoats, furs and overshoes. There is danger, too, in insufficient dress. One cannot with impunity go lightly clad on cold raw days or in windy weather, unless constantly exercising. When in a state of perspiration the danger is increased. We warn against exposure to extreme cold immediately after indulging in a heavy meal, or using alcohol. The latter causes a marked determination of the blood to the surface of the body and so increases the dissipation of heat. Taking hot baths and going out doors immediately is hazardous for the same reason.

For the purpose of hardening the body against colds, frequent exposure of the naked skin to cold air and frequent use of cold water baths are indispensable. To be condemned are such fads as going bareheaded, and barefooted, and constantly without overcoats.

Exercise in the open is most valuable. People on camping, hunting and yachting parties almost never contract colds. Games requiring reasonable physical exertion are of great benefit and the benefit is increased no doubt by the accompanying pleasant mental diversion.

Instructions given for the intervals between colds do not apply to the time when one is in the grip of an attack. A cold once contracted, one should eschew strenuous exercise, avoid exposure to severe cold and sudden changes and refrain from taking cold baths. It is advisable to go on a light diet without meat, and with predominance of fruit and fruit juices. A laxative and a good sweat at the beginning of a cold is usually helpful, and if there is fever, one should go to bed, or at least rest quietly.

No one kind of medical treatment is good for all kinds of cold, or for the same cold at different stages. With the occurrence of any unusual symptom indicating a possible complication, as pain in the ear or cheek or forehead, or severe headache, a physician should be called.

For many individuals the tendency to contract colds, depends upon some local lesion in the nose and throat which must be corrected. Nasal obstruction must be removed because it produces irritation, interferes with the drainage of the sinuses and interferes with the important function of respiration. Children with adenoids and diseased tonsils are in the constant throes of head colds; and on account of the adenoids especially liable to serious trouble with the ears. It is best not to remove the adenoids of children under five years of age, but even this sometimes is necessary when they are evidently producing harm.

In adults tonsils often become infected, and serve as a starting place for inflammation which may have serious results. There should be no question of their removal in such circumstances. No harm is known to result from their removal, and the benefit has been attested by many thousands of cases. Hemorrhage following the operation is an accident not to be feared when the operation is done by a competent specialist, and care taken to ligate all bleeding vessels at the time, in the manner recommended by the author.

An even more frequent cause of cold in adults is a diseased sinus. A pus focus in any of the paranasal sinuses will keep the nasal passages continually irritated and congested, so that these patients seem never to be free from a cold, and severe exacerbations may occur upon slight pretexts.

Contrary to general opinion there may be considerable disease in a sinus unaccompanied by pain, so that one cannot know that he is free except by examination by a competent specialist. One cannot even rely altogether upon a negative report from x-ray examination, as these have sometimes proved misleading.

One of the very inconvenient consequences of a spread of a cold downward is the involvement of the larynx, giving rise to hoarseness or loss of the voice. This is a matter of great concern to all persons, but especially to singers, lecturers, actors and public speakers.

Mouth breathing and the inhalation of dust, smoke and irritating gases, also the abuse of the voice, must be added as special causes of inflammation of these parts. These causes are therefore to be avoided as a means of prevention, and also during an attack, as otherwise they aggravate the situation and prevent recovery.

In conclusion, to answer very summarily the questions which we imagined to be asked in the beginning of this work, viz., how a cold is caught, how avoided and how if caught, gotten rid of, we must say, (1) that one is destined to catch cold if his resistance has been so lowered by predisposing causes, that it is unequal to the unfavourable action of the special exciting causes; (2) that to avoid a cold one must eliminate or as much as possible avoid the predisposing causes and one must accustom himself to the action of ordinary exciting causes, and build up a special resistance to the extraordinary ones, and (3) to get rid of a cold one should take care not to antagonise nature, but take measures which tend to assist her in her efforts to reduce the irritation due to the exciting causes, and to repair the damages done which result therefrom.

What these predisposing and exciting causes are and how they act; how by special precautions we can escape their evil effects or by special measures render them harmless; and what in the event of failure is best to be done,—these matters we have set forth in some detail, and attempted to fully explain, in the body of the book in chapters dealing in particular with these special subjects.